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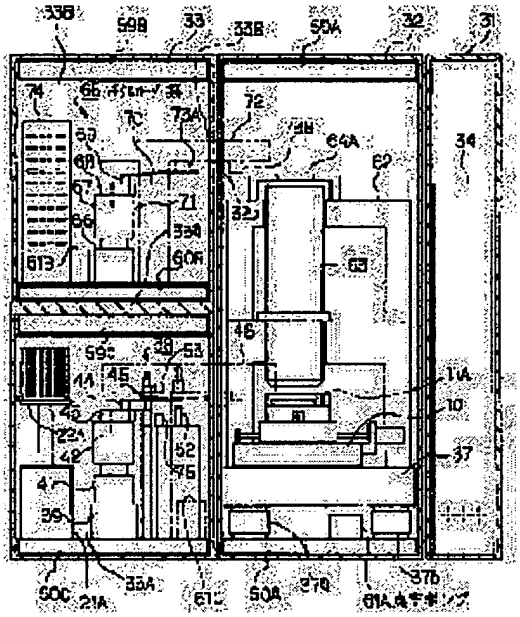
(54) ALIGNER

(57)Abstract:
PURPOSE: To reduce the probability of the dust, etc., raised in a wafer loader system or a reticle loader system getting in the aligner main body.
CONSTITUTION: The aligner main body including an wafer stage 10 is provided in the second independent chamber 32 and then a wafer loader system 38 is provided in the lower chamber 33A of the third independent chamber 33 while a reticle loader system 65 is provided in the upper chamber 33B of the chamber 33 so that the independent chamber 32, lower chamber 33A and upper chamber 33B may be independently air-conditioned using an air conditioner 34 having three each of air-conditioning units. Besides, wafers are to be delivered to the aligner main body through the intermediary of the vertical slider main body of the wafer loader 38.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] In an aligner which exposes a pattern on a mask on a sensitization substrate conveyed continuously, respectively While installing the exposure main part section which exposes said mask pattern on a sensitization substrate carried in from the outside in the 1st environmental maintenance interior of a room and taking out an exposed sensitization substrate Install on the base of the 2nd environmental maintenance interior of a room which was able to establish a substrate conveyance means which takes out a sensitization substrate from the storage section of a sensitization substrate independently of said 1st environmental maintenance room, and it lets a opening of the boundary section of said 1st environmental maintenance room and said 2nd environmental maintenance room pass. An aligner characterized by said substrate conveyance means performing taking out and carrying in of a sensitization substrate to said exposure main part section.
[Claim 2] The 3rd environmental maintenance room where a mask conveyance means to perform taking out and carrying in of a mask was installed on said 2nd environmental maintenance room is accumulated. Establish said 1st environmental maintenance room, the 2nd environmental maintenance room, and an air-conditioning means to perform 3rd air-conditioning of the environmental maintenance interior of a room mutually-independent, and it lets a opening of the boundary section of said 1st environmental maintenance room and said 3rd environmental maintenance room pass. An aligner according to claim 1 characterized by said mask conveyance means performing taking out and carrying in of a mask to said exposure main part section.
[Claim 3] The 1st source of vacuum adsorption for carrying out adsorption maintenance of said mask and said sensitization substrate in said exposure main part department in an exposure location, respectively, An aligner according to claim 1 or 2 characterized by preparing the 2nd source of vacuum adsorption for carrying out adsorption maintenance of said sensitization substrate within said substrate conveyance means at the time of conveyance, and the 3rd source of vacuum adsorption for carrying out adsorption maintenance of said mask within said mask conveyance means at the time of conveyance mutually-independent.
[Claim 4] A substrate conveyance means centers on a predetermined shaft. Rotation ease, And a migration means to move to radial a substrate attaching part and; this substrate attaching part which have two elastic flexibility along with a predetermined guide from said predetermined shaft; It lets a opening of the boundary section of said 1st environmental maintenance room and said 2nd environmental maintenance room pass. It consists of a light transmission means which delivers and receives a sensitization substrate between said substrate attaching part and said exposure main part section and which carried out; this substrate delivery with a means by carrying out substrate delivery, and was attached to a means, and a light-receiving means. Claims 1 and 2 characterized by having a substrate condition detection means to detect a location and an angle of rotation of said sensitization substrate based on a photo-electric-conversion signal from this light-receiving means, and;, or an aligner given in three.
[Claim 5] An aligner of claim 1-4 characterized by forming the contact section of said substrate conveyance means and sensitization substrate from conductive ceramics given in any 1 term.
[Claim 6] An aligner of claim 1-5 characterized by having formed from a diaphragm which isolates at a time one sensitization substrate contained by a box and this box in the storage section of said sensitization substrate, and forming said box and said diaphragm from a conductive material, respectively given in any 1 term.
[Claim 7] An aligner according to claim 6 characterized by securing a shelf which contains a substrate for inspection or cleaning to storage circles of said sensitization substrate.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the aligner equipped with the wafer loader system for taking out a wafer from the wafer stage (unload) while carrying in the wafer especially equipped with the notch for positioning (an orientation flat and notch) on a wafer stage about the aligner used for example, by the semiconductor device manufacturing process (loading).
[0002]
[Description of the Prior Art] In the aligner currently used at the photolithography production process for manufacturing a semiconductor device, in order to expose a photo mask or the pattern of a reticle on the wafer of one lot efficiently, it has the wafer loader system for performing carrying in and taking out of a wafer. Furthermore, the aligner is equipped also with the reticle loader system for choosing a desired reticle out of many reticles, and setting it as an exposure location.
[0003] Drawing 11 is the plan showing the aligner equipped with the conventional wafer loader system, and is set to this drawing 11 . It has an air-conditioner 2 in the chamber 1 mostly isolated from the open air. Pure air blows off from an air-conditioner 2 as a side flow in a chamber 1 through a vent pipe 3 and HEPA filter 4 for dust removal (High EfficiencyParticlate Air Filter). The air which circulated the inside of a chamber 1 is returned to an air-conditioner 2 through a return (exhaust port) 5 and a vent pipe 6.
[0004] Moreover, the vibrationproofing base 8 is installed on the floor 7 of a chamber 1, the wafer stage 10 where wafer 11A for exposure is laid on this vibrationproofing base 8 is installed, and the wafer stage 10 consists of Y stage 9Y which moves in the direction of Y on the base, an X stage where it moves in the direction of X, and wafer holder 9T grade holding a wafer. the lateral portion of the wafer stage 10 -- and the wafer loader system 12 is arranged on the vibrationproofing base 8. A notch (orientation flat section or notch section) is formed in a part of periphery of wafer 11A, and the wafer loader system 12 installs wafer 11A on the wafer stage 10 so that the notch may become position relation to the wafer stage 10 (loading).
[0005] Fundamentally, on the main part 13 of a horizontal slider prolonged in the direction of X, the wafer loader system 12 fixes the main part 18 of a vertical slider prolonged in the direction of Y, and is constituted. On two installation bases 21A of the lateral portion of the main part 13 of a horizontal slider, and 21B, the storage shelves 22A and 22B for process wafers are laid, respectively, and the wafer exposed in these storage shelf 22A and 22B after this or the already exposed wafer is kept.
[0006] random access section (wafer adsorption arm which can move freely) 14B for taking out the wafer in random access section (wafer adsorption arm which can move freely) 14A for taking out the wafer in storage shelf 22A, and storage shelf 22B on the main part 13 of a horizontal slider -- wafer delivery is carried out, the section 15 and the positioning base 16 are attached, and the turntable 17 is implanted in the positioning base 16. Furthermore, along with the edge section, the conveyance arm 20 is arranged free [migration in the direction of X] at the near side of the main part 13 of a horizontal slider, and two conveyance arms 19A and 19B are formed free [migration] along with the edge section on the left-hand side of the main part 18 of a vertical slider. The wafer taken out by random access section 14A or 14B is conveyed on a turntable 17 by the conveyance arm 20.
[0007] As drawing 12 shows the configuration of the wafer loader system 12 in drawing 11 and shows it to this drawing 12 , the location amendment section 25 is arranged on the positioning base 16 (a turntable 17 is included). A pin (un-illustrating) is projected so that the periphery section of the wafer which is rotating on that turntable from the location amendment section 25 may be contacted, based on the contact condition of this pin, the center position of a wafer and the location of a notch are detected, and the center of a wafer and the location of a notch are set as a position based on

this detection result. Then, the wafer on a turntable is conveyed by conveyance arm 19A at a wafer stage side. Furthermore, in drawing 12 , the A section shows the condition which delivers a wafer with a coater developer of having carried out in-line delivery and having prepared the unit in the left end of the main part 13 of a horizontal slider. In-line delivery is carried out and a unit means the transport device which takes out a wafer [finishing / exposure] to a developer (developer) etc. from the transport device which carries in a wafer to an aligner from the coater of a photoresist etc., or an aligner. The B section shows the condition of having prepared random access section 14C for extension, and installation base 21C equipped with the storage shelf of a wafer in the wafer loader system 12, and the C section shows the condition of having carried out in-line delivery and having prepared the unit in the right end of the main part 13 of a horizontal slider.

[0008] Return and the 1st carry out in-line delivery, a unit 23 consists of arm 23a and slide shaft 23b, the 2nd carries out in-line delivery, and a unit 24 becomes drawing 11 from arm 24a, slide shaft 24b, and rotation section 24c. Wafer 11B which carried out [B] in-line delivery and arm 23a of a unit 23 received from the coater developer (un-illustrating) is passed to the conveyance arm 20 in a location P1. Wafer 11C which similarly carried out [C] in-line delivery and arm 24a of a unit 24 received from the coater developer (un-illustrating) is passed to the conveyance arm 20 through a location P2 and a location P3. Or in-line delivery is carried out and a wafer is passed to reverse from units 23 and 24 to a coater developer (un-illustrating).

[0009] In the above-mentioned conventional wafer loader system 12 The conveyance arm 20, conveyance arm 19A, Conveyance arm 19B, arm 23a, arm 24a, the random access sections 14A and 14B, the positioning base 16, and a turntable 17 It was formed from alumina ceramics (that in which aluminum 2O3 was contained 95% or more), respectively, and was substituted for the resin storage shelf (thing containing 25 wafers) mainly used in the actual process as storage shelves 22A and 22B of a wafer.

[0010] Furthermore, the reticle loader system (un-illustrating) was also installed on the vibrationproofing base 8 with the wafer loader system 12. By the reticle loader system, a desired reticle is taken out from the inside of a reticle case, and it installs in an exposure location.

[0011]

[Problem(s) to be Solved by the Invention] In the Prior art like the above, the wafer loader system 12 and the reticle loader system were installed with the wafer stage 10 on the vibrationproofing base 8. Therefore, there was un-arranging [that there was a possibility that the positioning accuracy of propagation and the wafer stage 10 may get worse / the vibration when conveying a wafer or a reticle by the wafer loader system 12 or the reticle loader system / to the wafer stage 10 side]. Furthermore, by the drive of the positioning device of each arm at the time of conveying a wafer or a reticle, dust might mix in the perimeter of the wafer stage 10 in a chamber 1, or the temperature of the perimeter might be changed.

[0012] Moreover, by one air-conditioner 2, and 1 set of HEPA filters 4 and a return 5, since the whole inside of a chamber 1 was air-conditioned, in the exposure section of a wafer, the main part 13 of a horizontal slider of the wafer loader system 12, the reticle loader system, etc., the air-conditioning engine performance required for each was not obtained, or it might become exaggerated spec. When the wafer loader system 12 was in the windward of the exposure section, concerning this, the particle generated by the wafer loader system 12 or a temperature change might have a bad influence on the lee exposure section.

[0013] Furthermore, when performing delivery of a wafer with a coater developer as shown in drawing 11 for example, dedication needed to carry out in-line delivery, a unit 23 and 24 grades needed to be installed, and the whole structure was complicated. Moreover, since the wafer was positioned by the method to which a pin is actually contacted to a wafer on a turntable 17 when a wafer was loaded on the wafer stage 10, highly precise positioning was difficult. Therefore, after installing a wafer on the wafer stage 10 conventionally, X stage 9X or Y stage 9Y is moved, and the location of a wafer is corrected, or the wafer was surfaced from the wafer stage 10 by the air flow, it needed to carry out pressing a wafer against a positioning member etc., re-positioning of a wafer needed to be performed, control became complicated, and there was a problem of the raising dust by the air flow etc. further.

[0014] Moreover, since alumina ceramics (aluminum 2O3 is 95% or more) or resin was used for the conveyance arm 20 grade, there were problems, such as adhesion of the dust by electrification of a wafer or a conveyance arm. Similarly, since the storage shelves 22A and 22B of a wafer were also the things of the resin for processes, there were problems, such as adhesion of the dust by the above-mentioned electrification and an access mistake of the wafer by deformation of a shelf. In addition, when a resist dropped out of the edge section and the rear face of a wafer in storage shelf 22A and 22B, there was also un-arranging [that a very fine particle adhered to the wafer of the lower berth from it].

[0015] Cleaning of the conveyance side of a wafer and the contact surface with the wafer on wafer holder 9T was conventionally performed about this by pressing a **** disk against each contact surface lightly, and letting it slide by

the manual, and the time amount which cleaning takes was long.
[0016] In the aligner which exposes the pattern of a reticle, respectively on the wafer with which sequential conveyance of the 1st purpose of this invention is carried out by the wafer loader system in view of this point, while vibration produced when conveying a wafer by the wafer loader system makes it hard to get across to the main part of an aligner (exposure section), it is reducing the probability the dust generated by the wafer loader system mixing in the main part of an aligner.
[0017] Furthermore, the 2nd purpose of this invention is reducing the probability the dust generated by this reticle loader system mixing in the main part of an aligner, when a reticle loader system is prepared in that aligner. Moreover, the 3rd purpose of this invention is that carrier delivery of a wafer is made to be made easily, without establishing an additional device especially, in case delivery of external equipments (the coater of a resist or developer) and a wafer is performed through the wafer loader system.
[0018] Moreover, the 4th purpose of this invention is decreasing electrification of the wafer conveyed by the wafer loader system or removing the electrified charge of a wafer, and in case the 5th purpose of this invention cleans the conveyance side of a wafer, it is preventing the operating ratio fall of an aligner, the temperature fluctuation in a chamber, mixing from outdoor [of a very fine particle], etc.
[0019]
[Means for Solving the Problem] In an aligner with which an aligner by this invention exposes a pattern on a mask on a sensitization substrate (11A) conveyed continuously, respectively While installing the exposure main part section (10, 62, 63) which exposes the mask pattern on a sensitization substrate (11A) carried in from the outside in the 1st environmental maintenance room (32) and taking out an exposed sensitization substrate A substrate conveyance means (38) which takes out a sensitization substrate from the storage section (55) of a sensitization substrate Install on the base in the 2nd environmental maintenance room (33A) prepared independently of the 1st environmental maintenance room (32), and it lets a opening (32a, 33b) of the boundary section of the 1st environmental maintenance room (32) and the 2nd environmental maintenance room (33A) pass. The substrate conveyance means is made to perform taking out and carrying in of a sensitization substrate to the exposure main part section.
[0020] In this case, the 3rd environmental maintenance room (33B) where a mask conveyance means (65) to perform taking out and carrying in of a mask (64A) on the 2nd environmental maintenance room (33A) was contained is accumulated. The 1st environmental maintenance room (32), the 2nd environmental maintenance room (33A), and an air-conditioning means (34) to perform air-conditioning in the 3rd environmental maintenance room (33B) mutually-independent are established. It is desirable to let a opening (32b, 33g) of the boundary section of the 1st environmental maintenance room (32) and the 3rd environmental maintenance room (33B) pass, and for a mask conveyance means (65) to perform taking out and carrying in of a mask to the exposure main part section.
[0021] Moreover, the 1st source of vacuum adsorption for carrying out adsorption maintenance of a mask and the sensitization substrate in the exposure main part department in an exposure location, respectively (61A), It is desirable to prepare the 2nd source of vacuum adsorption for carrying out adsorption maintenance of the sensitization substrate within the substrate conveyance means at the time of conveyance (61C) and the 3rd source of vacuum adsorption for carrying out adsorption maintenance of the mask within the mask conveyance means at the time of conveyance (61B) mutually-independent.
[0022] Moreover, a substrate attaching part in which an example of the substrate conveyance means has two elastic flexibility from rotation ease and its predetermined shaft to radial centering on a predetermined shaft (47), A migration means to which this substrate attaching part is moved along with a predetermined guide (39) (41), It lets a opening (32a, 33b) of the boundary section of the 1st environmental maintenance room (32) and the 2nd environmental maintenance room (33A) pass. A sensitization substrate between a substrate attaching part (47) and its exposure main part section is delivered and received, and substrate delivery is carried out. A means (48, 49A, 51, 52), It consists of this light transmission means (76A- 76D, 53) and light-receiving means (78A- 78D, 75) that carried out substrate delivery and were attached to a means, and has a substrate condition detection means to detect a location and an angle of rotation of that sensitization substrate based on a photo-electric-conversion signal from this light-receiving means.
[0023] Moreover, it is desirable to form the contact section of the substrate conveyance means (38) and sensitization substrate from conductive ceramics. Furthermore, it is desirable to form from a diaphragm (791, 792, --) which isolates at a time one sensitization substrate contained by a box (55) and this box in the storage section (55) of that sensitization substrate, and to form those box and these diaphragms from a conductive material, respectively.
[0024] Moreover, it is desirable to secure a shelf (79 Ns) which contains a substrate for inspection or cleaning in the storage section (55) of the sensitization substrate.
[0025]

[Function] According to this invention, two environmental maintenance rooms (32 33A) are prepared independently, the exposure main part section (10, 62, 63) and a substrate conveyance means (38) are independently installed in the 1st and 2nd environmental maintenance interior of a room, respectively, and, as for a substrate conveyance means, carrier delivery of a sensitization substrate is performed through the opening of the boundary section of these two environmental maintenance rooms. Therefore, vibration generated in case a sensitization substrate is conveyed through a substrate conveyance means, or dust has propagation-come to be hard in the exposure main part section.
[0026] moreover, when the 3rd environmental maintenance room (33B) where a mask conveyance means (65) to perform taking out and carrying in of a mask (64A) on the 2nd environmental maintenance room (33A) was contained is accumulated vibration, dust, etc. which are generated at the time of the drive of a mask conveyance means (65) -- the exposure main part section -- propagation -- being hard -- while -- the dust within a substrate conveyance means (38), etc. the dust within a mask conveyance means (38), etc. do not have a bad influence on a partner mutually. furthermore, when the 1st environmental maintenance room (32), the 2nd environmental maintenance room (33A), and an air-conditioning means (34) to perform air-conditioning in the 3rd environmental maintenance room (33B) mutually-independent are established Generally, since the temperature precision of the gas needed with the exposure main part section, a substrate conveyance means, and a mask conveyance means, KURINNESU, and a pressure differ from a flow rate respectively, it supplies the respectively optimal gas for each part from the air-conditioning means (34). moreover, the 1- it considers as the structure where the rigidity for which the structure of the 3rd environmental maintenance room is also needed with the exposure main part section, a substrate conveyance means, and a mask conveyance means, respectively is acquired.
[0027] Next, the 1st source of vacuum adsorption for carrying out adsorption maintenance of a mask and the sensitization substrate in the exposure main part department in an exposure location, respectively (61A), The 2nd source of vacuum adsorption for carrying out adsorption maintenance of the sensitization substrate within the substrate conveyance means at the time of conveyance (61C), When the 3rd source of vacuum adsorption for carrying out adsorption maintenance of the mask within the mask conveyance means at the time of conveyance (61B) is prepared mutually-independent, for example, even if it performs adsorption or separation of a sensitization substrate within a substrate conveyance means, the effect does not get across to an exposure main part section and mask conveyance means side. Moreover, when pressure fluctuation gets across to the source of vacuum adsorption (61A) in the exposure main part section, there is fear of a location gap of a mask or a sensitization substrate, but in this invention, since the source of vacuum adsorption (61A) is independent, those location gaps do not take place.
[0028] Furthermore, the substrate attaching part in which the substrate conveyance means has two elastic flexibility from rotation ease and its predetermined shaft to radial centering on a predetermined shaft (47), When it has the migration means (41) to which this substrate attaching part is moved along with a predetermined guide (39), the substrate attaching part (47) which has two flexibility performs carrier delivery of a sensitization substrate with the external devices (the coater of sensitization material, or developer) of separate installation. Even if the external device approaches and is arranged from any, such as right and left or the front, to a substrate conveyance means, the substrate attaching part (47) can perform carrier delivery of a sensitization substrate. Moreover, since [which was separately established like before] it is not necessary to carry out in-line delivery and to use a unit, the count of carrier delivery of a sensitization substrate decreases, the possibility of raising dust falls, and reliability of operation improves.
[0029] Moreover, carry out substrate delivery and it becomes a means (48, 49A, 51, 52) from a light transmission means (76A- 76D, 53) and a light-receiving means (78A- 78D, 75). When a substrate condition detection means to detect the location and angle of rotation of that sensitization substrate based on the photo-electric-conversion signal from this light-receiving means is established, this substrate condition detection means detects the center position of a sensitization substrate, the location of the notch of a sensitization substrate, etc. to high degree of accuracy by non-contact optically. In case a substrate attaching part (47) carries out substrate delivery and passes a sensitization substrate to a means (48, 49A, 51, 52) based on this detection result, the center position of this sensitization substrate is positioned to a position in a two-dimensional plane. Then, the angle of rotation of the sensitization substrate is adjusted so that the notch of the sensitization substrate may come [a carrier beam substrate delivery means] a sensitization substrate to a position, for example. Thereby, the detection equipment of the notch of the sensitization substrate of the contact process currently used conventionally and the PURIARAIMENTO devices (the device which a wafer is surfaced and is centered, or device using an X-Y stage) of a sensitization substrate become unnecessary.
[0030] Moreover, since the center position of a sensitization substrate and the location of a notch are detected by high degree of accuracy, the center can be easily rotated for the sensitization substrate as a shaft. Then, the light of the same wavelength range as the exposure light which makes the periphery section of the sensitization substrate under the rotation expose the sensitization substrate through a floodlighting means may be irradiated. Thereby, the so-called

circumference exposure which exposes only the periphery section of a sensitization substrate is attained. When the periphery section of a sensitization substrate is unexposed, circumference exposure is performed in order to prevent that dust etc. is generated from the periphery section after processing of development etc. The exposure width of face on the sensitization substrate by circumference exposure will vary with the alignment precision of the center of the sensitization substrate under rotation. What is necessary is just to move that floodlighting means or the rotation means of a sensitization substrate to radial [of that sensitization substrate] according to the rotation location of that sensitization substrate to make this dispersion small.

[0031] furthermore, when the contact section with the sensitization substrate of a substrate conveyance means (38) is formed using the conductive ceramics which has the precise surface, for example ** ** whose raising dust connection by the sensitization substrate becomes small and decreases, while static electricity of the sensitization substrate with which electrification of the contact section and a sensitization substrate is avoided, and a dust collection operation is reduced and of which ** electrification was done is removed and the electrostatic discharge of a sensitization substrate is prevented ** by which a dust collection operation of a sensitization substrate is reduced -- the anchor effect (the drag effect) at the time of particle (very fine particle) adhesion is reduced according to the contact section being precise, and cleaning becomes easy -- the operation effect of ** is done so. Therefore, the possibility of adhesion of the particle to the rear face of a sensitization substrate or the surface is reduced, and improvement in the yield at the time of exposure can be expected.

[0032] Next, also when the box (55) of the storage section (55) of a sensitization substrate and a diaphragm are formed from a conductive material, a dust collection operation with the storage section (55) and a sensitization substrate is reduced, and the yield at the time of exposure improves. Furthermore, the dust generated from the rear face or the edge section of a sensitization substrate of an upper case being omitted, and adhering to the surface of the sensitization substrate of the lower berth is avoided by having formed the diaphragm. Moreover, when [which installed the sensitization substrate, for example on three pins (or more than it)] prepared on these diaphragms, as compared with the method which lays a sensitization substrate in shelving which has a crevice like the conventional storage section, it is weak in crystal and can avoid especially that the edge of the sensitization substrate to which a photoresist may adhere contacts the storage section (55).

[0033] Moreover, if the number of sheets of the sensitization substrate for the usual exposure is made for example, into 25xN (N is zero or more integers) ** when the shelf (79 Ns) which contains the substrate for inspection or cleaning in the storage section (55) of a sensitization substrate is secured, the receipt of the sensitization substrate of ** (25xN+1) will be attained at the storage section (55). For example, after incorporating the substrate the inspection or for cleaning in a substrate conveyance means (38) from the storage section (55) and making it move within the substrate conveyance means (38) at the time of cleaning of a substrate conveyance means (38), it is made to return to the storage section (55) again. Mixing of dust, a temperature change, etc. are avoided compared with the case where it cleans by opening and closing an environmental maintenance room (33A), and setting or taking out the substrate for cleaning by the manual by this. Thereby, the count of cleaning can also be reduced. Thereby, improvement in the operating ratio of an aligner can be measured.

[0034]

[Example] Hereafter, with reference to a drawing, it explains per 1st example of the aligner by this invention. Drawing 1 is the plane cross section of the chamber of the aligner of this example, and arranges three mutually-independent independent chambers 31, 32, and 33 side by side in this drawing 1 . Drawing 2 is a cross section which meets AA line of drawing 1 , and as shown in this drawing 2 , it divides the 3rd independent chamber 33 into lower chamber 33A and upper chamber 33B by diaphragm 33a.

[0035] In the 1st independent chamber 31, the air-conditioner 34 which consists of three air-conditioning units which operate mutually-independent is installed. The air by which the temperature control was carried out in the 1st air-conditioning unit in an air-conditioner 34 The 1st piping 35A, And it is made to blow off in the independent chamber 32 through HEPA filter 59A for dust removal installed in the ceiling of the 2nd independent chamber 32 of drawing 2 , and returns to the 1st air-conditioning unit through return 60A installed in the floor of the independent chamber 32, and 1st piping 36A. Moreover, the air by which the temperature control was carried out in the 2nd in an air-conditioner 34 and the 3rd air-conditioning unit is led to HEPA filter 59B installed in the ceiling of HEPA filter 59C installed in the ceiling of lower chamber 33A of the 3rd independent chamber 32 of drawing 2 through the 2nd piping 35B and 3rd piping 35C, respectively, and upper chamber 33B. And the air which carried out the downflow to lower chamber 33A from HEPA filter 59C, and reached return 60C, and the air which carried out the downflow to upper chamber 33B from HEPA filter59B, and reached return 60B are returned to the 2nd and 3rd air-conditioning units through the 2nd piping 36B and 3rd piping 36C, respectively.

[0036] In addition, although not illustrated, it is good to prepare the chemical filter which prevents penetration of the independent chambers 32 and 33A which install the main part of an aligner, a wafer loader system, etc., the ion (for example, NH4+, SO42-) which exists in 33B, a sulfur dioxide (SO2), etc. together with HEPA filters 59A-59C. Generating of the phenomenon of adhering to the optical element which an ammonium sulfate (NH4) (2SO4) etc. is generated, and constitutes an illumination-light study system by this, and reducing the reflection factor or permeability, and the phenomenon in which the cross-section configuration of a resist pattern becomes T character-like can be prevented. What is necessary is just to prepare this chemical filter corresponding to each of three HEPA filters 59A-59C. However, as a chemical filter is prepared in HEPA filter59A at least, you may make it not prepare a chemical filter in other HEPA filters 59B and 59C. .

[0037] In drawing 2 , the main part of an aligner is installed in the 2nd independent chamber 32. That is, the vibrationproofing base 37 is installed in above the floor level [of the independent chamber 32] through vibration absorbing pads 37a and 37b, the wafer stage 10 is installed on the vibrationproofing base 37, and wafer 11A by which the photoresist was applied on the wafer stage 10 is loaded at the time of exposure. A column 62 is implanted on the vibrationproofing base 37, projection optics 63 is fixed to the middle of a column 62, and reticle 64A made applicable to exposure is laid on the reticle holder of the upper limit section of a column 62.

[0038] Return and the wafer stage 10 are constituted from base 9B, Y stage 9Y, X stage 9X, and wafer holder 9T grade by drawing 1 , and wafer 11A for exposure is held by vacuum adsorption on wafer holder 9T at it. Wafer 11A is loaded on wafer holder 9T so that the notch called an orientation flat (or notch) may be formed in a part of circular periphery of wafer 11A and this notch may turn to a predetermined direction, and so that the center of wafer 11A may become position relation to wafer holder 9T. In this example, the wafer loader system 38 for taking out carrying in (loading) of the wafer to the wafer holder 9T top and its wafer from wafer holder 9T (unload) is installed in above the floor level [in lower chamber 33A (refer to drawing 2) of the 3rd independent chamber 33].

[0039] The guide section of the wafer loader system 38 is constituted from a main part 39 of a horizontal slider prolonged in the direction of X, and a main part 48 of a vertical slider prolonged in the direction of Y, and the scalar type robot hand 47 is arranged for the direction of X on the main part 39 of a horizontal slider, enabling free sliding. The scalar type robot hand 47 It centers upon center 42a of the X-axis migration section 41 which moves in the direction of X in accordance with the main part 39 of a horizontal slider, the Z-axis migration section 42 which are expanded and contracted in a Z direction perpendicular to XY plane on this X-axis migration section 41, and this Z-axis migration section 42. It constitutes from the hand section 45 prepared at the tip of rotating theta shaft rotation section 43, R shaft rotation section 44 prepared at the tip of this theta shaft rotation section 43 free [rotation], and this R shaft rotation section 44 free [rotation], and the vacuum adsorption section 46 is attached in the point of the hand section 45. By rotating center 42a as a shaft, the hand section 45 rotates theta shaft rotation section 43 in the direction of theta, and the location from center 42a of the hand section 45 to radial (the direction of R) can be adjusted by combining the angle of rotation of R shaft rotation section 44 and the hand section 45.

[0040] Moreover, on installation base 21A installed in the lateral portion of the main part 39 of a horizontal slider, and 54, the storage shelves 22A and 55 for keeping a wafer, respectively are fixed, and the temporary every bases 56A and 56B of the wafer for laying a wafer in primary further are installed. On temporary every base 56A and 56B, a pin [two or more / for wafer installation / (drawing 1 four pieces)] is implanted. The openings 33d and 33e for exchanging a storage shelf etc. from the exterior, respectively are formed in the side of the independent chamber 33 near the temporary every bases 56A and 56B at the list near the storage shelves 22A and 55. By projecting the hand section 45 of the scalar type robot hand 47 from opening 33c of the left lateral of the independent chamber 33, wafer 11D to external devices (the coater of an external photoresist or developer) can be delivered, and wafer 11E can be delivered also in another location Q1. Furthermore, by moving the scalar type robot hand 47 to a location Q7, and projecting the hand section from 33f of openings of the right lateral of the independent chamber 33, wafer 11F with an external device can be delivered, and wafer 11G can be delivered also in another location Q8. Similarly, the wafer to the storage shelf 55, temporary every base 56A, or temporary every base 56B can be delivered, respectively by moving the scalar type robot hand 47 to locations Q3 and Q5 or Q6.

[0041] Moreover, the main part 48 of a vertical slider has projected in the independent chamber 32 through opening 33b of the side of opening 32a of the side of the independent chamber 32, and lower chamber 33A of the independent chamber 33, and the contact section with a wafer attaches two character type sliders 49A and 49B of KO in the side of the main part 48 of a vertical slider free [sliding] at a longitudinal direction. These two sliders 49A and 49B are in the condition which held the wafer by vacuum adsorption, respectively, and move independently between the inside of the independent chamber 32 and lower chamber 33A. And the scalar type robot hand 47 passes a wafer to slider 49A or 49B in a location Q4 through the turntable 52 which can move up and down, after picking out a wafer from the storage shelf

55. Then, the scalar type robot hand 47 which received the wafer after exposure from slider 49A or 49B through vertical movement of a turntable 52 similarly returns the wafer to the storage shelf 55.
[0042] Moreover, the portion which contacts a wafer like the hand section 45 of the scalar type robot hand 47, slider 49A, and slider 49B is formed from the conductive ceramics with the precise surface. However, the precise conductive ceramics may be put on the surface of the contact section with the wafer by coating etc. Next, near the field where the main part 39 of a horizontal slider and the main part 48 of a vertical slider cross (i.e., a location Q4 near), the sensor base 50 is installed and the center position sensor (after-mentioned) for detecting the center position of a wafer on this sensor base 50 is arranged. Arrange the adjustment base 51 to the sensor base 50 up side, and the turntable 52 made from the conductive ceramics which rotates a shaft perpendicular to XY plane as a center is formed in the upper part of the adjustment base 51. On this adjustment base 51, in and the location between a turntable 52 and the sensor base 50 The line sensor 75 (refer to drawing 2) which consists of the floodlighting section 53, 1-dimensional CCD, etc. of a notch detection sensor for detecting the location of the notch (orientation flat) of the shape of a straight line of the periphery section of a wafer is arranged. The floodlighting section 53 irradiates the light beam of the shape of a nonphotosensitivity slit to the photoresist on a wafer at a line sensor 75, and a line sensor 75 detects the length of the portion by which it was shaded of the light beams of the shape of the slit, and supplies a detection result to a non-illustrated control system.
[0043] Drawing 3 is the enlarged view of the B section in drawing 1 , and in this drawing 3 , when passing wafer 11J on a turntable 52 from the scalar type robot hand 47, wafer 11J pass through the inside of the sensor base 50 first. The four floodlighting sections 76A-76D are installed in the upper part of the sensor base 50, four light sensing portions 78A-78D are installed in the lower part of the sensor base 50 so that the floodlighting section may be countered, and wafer 11J are made to pass through between these floodlighting sections 76A-76D and light sensing portions 78A-78D, as shown in drawing 4 which is the cross section which meets CC line of drawing 3 . From the floodlighting sections 76A-76D, the illumination light of the shape of a nonphotosensitivity beam is injected to the photoresist on a wafer.
[0044] In this case, as shown in drawing 3 , since wafer 11J are almost circular, it asks for the center position of a wafer 11 according to a non-illustrated control system from the relation between the location to the turntable 52 direction of wafer 11J, and timing after light is shaded by wafer 11J by each of the light sensing portions 78A-78D of drawing 4 until light is received again. And the scalar type robot hand 47 lays wafer 11J on a turntable 52 so that the center position of wafer 11J may agree in the center of rotation of a turntable 52. In this case, slider 49A is moved to the rear face of wafer 11J. Moreover, based on said center position information, by performing control of R shaft of the scalar type robot hand 47, and control of theta shaft (or X-axis), wafer 11J are laid on a turntable 52 so that a center may agree. Vacuum adsorption of wafer 11J is carried out on a turntable 52. By such positioning method, the center of a wafer is positioned to the center of a turntable 52 in the precision of about about **0.2mm.
[0045] If a turntable 52 is rotated in the condition, the periphery section of wafer 11J will rotate between the floodlighting section 53 of a notch detection sensor, and a line sensor 75 (refer to drawing 2), and the location of a notch whose non-illustrated control system is the wafer 11J will be detected from the length of the protection-from-light section decreasing, in case the notch (an orientation flat or notch) of wafer 11J passes through a line sensor 75 top. According to this detection result, the notch of wafer 11J suspends rotation of a turntable 52 in the location which counters the main part 39 of a horizontal slider. Then, cancel the adsorption of wafer 11J on a turntable 52, and a turntable 52 descends. Carry out vacuum adsorption of wafer 11J, and the slider 49A is moved to the upper surface of slider 49A in accordance with the main part 48 of a vertical slider at the independent chamber 32 side of drawing 1 . Un-illustrating carries out wafer delivery and wafer 11J are moved from slider 49A on wafer holder 9T with a means (for example, it is prepared in wafer holder 9T, and is the movable pin which can move up and down (in direction perpendicular to the space of drawing 1) and by which the slot for vacuum adsorption was formed in the surface). In this case, the center of wafer 11J and the location of a notch will be in a predetermined condition correctly, and wafer 11J will be laid on wafer holder 9T.
[0046] Furthermore, generally on wafer holder 9T, concentric circle-like heights are, and wafer 11J are laid on these concentric circle-like heights. Then, as for the contact section of the wafer 11J in the scalar type robot hand 47 and Sliders 49A and 49B, it is desirable that you make it differ from the contact section on the wafer holder 9T. That is, the location on the rear face of a wafer in contact with the scalar type robot hand 47 and Sliders 49A and 49B is made to differ from the location on the rear face of a wafer in contact with the heights of wafer holder 9T. What is necessary is just to decide the location of the scalar type robot hand 47 and the contact section with the wafer of Sliders 49A and 49B, and area according to the configuration of the heights of wafer holder 9T at this time. Thereby, the flatness of the wafer on wafer holder 9T is maintainable good. This is because the foreign matter is not put between the heights of wafer holder 9T, and a wafer, even if a foreign matter adheres to a wafer rear face by contact to the scalar type robot

hand 47 and Sliders 49A and 49B.
[0047] In addition, the analog sensor which combined a cylindrical lens and one photo detector (for example, photodiode) may be used instead of the line sensor 75 of drawing 2 . If this analog sensor is used, since the light income of that photo detector changes according to the length of the protection-from-light section by the wafer, the length of that protection-from-light section is detectable. Moreover, the notch (an orientation flat or notch) of wafer 11J may be positioned by arranging 2 sets of combination of the floodlighting section 53 and an analog sensor to two places of the circumferencial direction of a wafer, and fixing the rotation location of a turntable 52 to them by the servo system so that the output signal of two analog sensors can be balanced.
[0048] The lightguide 77 to which the light obtained by dividing a part of exposure light for illuminating a reticle above return and the adjustment base 51 into drawing 3 is led is arranged. As drawing 7 is a cross section which meets EE line of drawing 3 and it is shown in this drawing 7 Injection edge 77a of lightguide 77 is attached in the upper limit section of the character type movable carriage 85 of KO. Slider 85a which fixed the line sensor 84 which consists of 1-dimensional CCD so that the lower limit section of a movable carriage 85 might be countered at the injection edge 77a, and was fixed to the base of a movable carriage 85 is installed in the guide section on the susceptor 86 fixed to the adjustment base 51. A drive motor 87 is fixed to susceptor 86, a feed screw 88 is screwed in the sliding direction of slider 85a, and parallel at the lateral portion of a movable carriage 85, and the feed screw 88 is combined with the axis of rotation of a drive motor 87 through coupling 89. The migration direction of a movable carriage 85 is radial [centering on a turntable 52], and can move a movable carriage 85 in accordance with radial [the] by driving a drive motor 87.
[0049] And at the time of the so-called circumference exposure, from injection edge 77a of lightguide 77, the slit-like exposure light which exposes the photoresist applied on wafer 11J is irradiated, with a line sensor 84, the length of the protection-from-light section of that exposure light is detected in the periphery section of wafer 11J which adsorb on the turntable 52, and this detection result is supplied to it at a non-illustrated control system. Circumference exposure means exposing only the photoresist of the periphery section of wafer 11J, in order to prevent the raising dust from the periphery section of wafer 11J. In this case, in this example, since the center of rotation of a turntable 52 and the center of wafer 11J have agreed almost correctly, it can be correctly set as the value of a request of the width of face of circumference exposure of wafer 11J by adjusting the location of a movable carriage 85 and making exposure light inject from injection edge 77a. Moreover, since the notch location of a wafer is known, when a motor with an encoder or a stepping motor is adopted as a turntable 52 and the notch of wafer 11J reaches between injection edge 77a and a line sensor 84, the notch of wafer 11J can also perform circumference exposure by fixed width of face by adjusting the location of a movable carriage 85 so that the width of face of circumference exposure may become fixed.
[0050] The reticle loader system 65 is installed at drawing 2 on return 60B in upper chamber 33B of return and the independent chamber 33. The guide section of the reticle loader system 65 consists of main parts 72 of a vertical slider which projected in the independent chamber 32 through 33g of openings of opening 32b of the independent chamber 32, and upper chamber 33B, and two sliders 73A and 73B are attached free [sliding] in accordance with the main part 72 of a vertical slider. And the scalar type robot hand which consists of the hand section 70 prepared free [rotation] at the tip of the base 66, the Z-axis migration section 67 expanded and contracted in a Z direction perpendicular to XY plane on this base 66, the theta shaft rotation section 68 which rotate the center of this Z-axis migration section 67 as a shaft, the R shaft rotation section 69 which were prepared free [rotation] at the tip of this theta shaft rotation section 68, and this R shaft rotation section 69 installs near the susceptor of the main part 72 of a vertical slider.
[0051] Moreover, the storage shelf 74 for reticles is installed near the scalar type robot hand for the reticles, from the storage shelf 74, in the hand section 70 of the scalar type robot hand, a reticle is passed to ejection and the reticle taken out in this way is passed to slider 73A or 73B of the main part of a vertical slider by vacuum adsorption. Then, slider 73A or 73B is in the condition which held the reticle by vacuum adsorption, and in accordance with the main part 72 of a vertical slider, it moves into the independent chamber 32, un-illustrating carries out reticle delivery, and it installs the reticle through a means on the reticle holder on the column 62 of the main part section of an aligner. Moreover, in case reticles are exchanged, the reticle taken out from the reticle holder is returned to the storage shelf 74 through slider 73A or 73B, and the scalar type robot hand for reticles. Thus, since the scalar type robot hand is used also at the time of conveyance of a reticle, the reticle loader system 65 is simplified.
[0052] In drawing 2 , vacuum pumps 61A, 61C, and 61B are installed, respectively in lower chamber 33A of the 2nd independent chamber 32 and the 3rd independent chamber 33, and upper chamber 33B. Furthermore, by vacuum pump 61A The negative pressure for vacuum adsorption with the main part of an aligner in the independent chamber 32 is supplied, the negative pressure for vacuum adsorption by the wafer loader system 38 in chamber 33A is supplied by vacuum pump 61C, and the negative pressure for vacuum adsorption by the reticle HARODA system 65 in chamber

33B is supplied by vacuum pump 61B. Thus, in this example, since vacuum adsorption with the main part of an aligner, vacuum adsorption by the wafer loader system 38, and vacuum adsorption by the reticle loader system 65 are performed independently, there is an advantage from which adsorption of a wafer or the effect of [at the time of balking] is not transmitted mutually. Moreover, by the wafer holder 9T side, while exposing the reticle pattern to the wafer which adsorbed on wafer holder 9T of the main part of an aligner in the independent chamber 32, even if it performs ON or OFF of vacuum adsorption by the wafer loader system 38 or the reticle loader system 65, since there is no pressure fluctuation, there is also an advantage that a wafer does not carry out a location gap.

[0053] Next, with reference to drawing 5 and drawing 6 , it explains to details per configuration of the storage shelf 55 in drawing 1 . Drawing 5 is drawing seen from [of drawing 1] view D, and as shown in this drawing 5 , the storage shelf 55 is a box which consists of a conductive material, and has structure from which order escaped. Moreover, the top plate and 79 Ns of bottom plates of the box The box and one are equipped with the diaphragm 791 which becomes order from a conductive material in between, 792, and --. Thereby, N wafers can be stored in the storage shelf 55, and examples of N sheets are ** (25xn+1), i.e., 26 sheets, 51 sheets, 76 sheets, etc. using one or more integers n. Or in the case of n= 0, N sheets are one sheet.

[0054] Moreover, it ****s on the installation base 54, and fixes by the stop, and the storage shelf 55 is the diaphragm 791 in the storage shelf 55. Upwards, three pins 80A, 81A, and 82A made from the conductive ceramics are implanted. Similarly, they are other diaphragms 792, 793, --, 79 Ns of bottom plates. Also upwards, three pins made from the conductive ceramics are implanted, respectively. For example, in case exposure to the wafer of one lot is performed, they are a diaphragm 791, 792, --, 79 Ns of bottom plates. Upwards, they are a wafer 111 and 112, --, 11N, respectively. It is installed. And wafer 111 In case it takes out from the storage shelf 55, as it is shown in drawing 6 which is the cross section which meets FF line of drawing 5 , it is the rear face and diaphragm 791 of a wafer 111 about the hand section 45 of the scalar type robot hand 47. It inserts in between and is the wafer 111. It takes out.

[0055] In this case, in this example, since there is 25xn number of sheets of the wafer of one lot at the time of the usual exposure, it can keep a wafer with many one more sheet on the storage shelf 55 of this example. However, it is good as for two or more sheets in the number of sheets of the wafer which can be kept too much. Into the portion which can be kept too much, the criteria wafer of the high flatness for the flatness measurement for example, on wafer holder 9T (refer to drawing 1), the master wafer for self-measurement of equipment, or the wafer for contact section cleaning of a wafer is kept. Although the space which can be contained too much in this way is secured to some storage shelves 55 in this example, an independent base like the temporary every bases 56A and 56B of drawing 1 may be used, for example.

[0056] Next, since order has escaped from the storage shelf 55 of this example, a checking light from order can be passed. Then, as shown in drawing 1 , a projector 57 and an electric eye 58 are arranged so that the storage shelf 55 may be inserted into the medial surface of a chamber. And the light beam injected from the projector 57 when there was no wafer into the storage shelf 55 passes through the inside of the storage shelf 55, and light is received by the electric eye 58, and when there is a wafer, the light beam is shaded. Thereby, the existence of the wafer in the storage shelf 55 can be checked. Furthermore, this function can be attained, if it is the transparent body even if a wall is behind the storage shelf 55.

[0057] In addition, although it ****s on the installation base 54 and the storage shelf 55 is fixed by the stop as shown in drawing 5 , the storage shelf 55 may be fixed according to the lock device which can be opened and closed freely. Thus, by having a lock device, the storage shelf 22 (refer to drawing 1) for the conventional process wafers is also fixable on the installation base 55. Moreover, in the above-mentioned example, as shown in drawing 3 , the notch sensor containing the detector and the floodlighting section 53 in the sensor base 50 had detected the center position of wafer 11J, and the location of a notch (an orientation flat or notch), respectively. However, as shown in drawing 8 , a line sensor may be arranged so that the floodlighting sections 90A-90D which irradiate a slit-like light beam caudad may be fixed to four upper places of the adjustment base 51, and these floodlighting sections 90A-90D may be countered and the periphery section of wafer 11J may be inserted. In this case, the center position of wafer 11J can be positioned in an outline in the center position of a turntable 52 by driving and positioning the location of the hand section 45 of a scalar type robot hand by the servo system in the direction of R, the direction of theta, or the direction of X so that the edge section of wafer 11J may come to a predetermined location on each line sensor.

[0058] Moreover, the notch (an orientation flat or notch) of wafer 11J is also detectable by using for example, floodlighting section 90of combination of floodlighting sections [these 4 sets of], and line sensor A, and the line sensor which counters this. In this case, even if the notch on wafer 11J has turned to which direction, since four line sensors are formed, the location of that notch is detectable only by rotating wafer 11J [about 90-degree] at the maximum. In addition, if the combination of the floodlighting section and a line sensor is 2 or more sets, the same positioning is possible for it.

[0059] Next, with reference to drawing 9 and drawing 10 , it explains per 2nd example of this invention. This example shortens the length of the main part 39 of a horizontal slider of the wafer loader system 38 in the example of drawing 1 , in drawing 9 and drawing 10 , gives the same sign to the portion corresponding to drawing 1 and drawing 3 , and omits the details explanation. Drawing 9 is a plan in the chamber of this 2nd example, in this drawing 9 , installs a wafer loader system in the lower chamber of the 3rd independent chamber 33, and constitutes the guide section of the direction of X of this wafer loader system from main part of horizontal slider 39A shorter than the case of the 1st example. Along with this main part of horizontal slider 39A, the scalar type robot hand 47 for holding a wafer is laid for the direction of X, enabling free sliding. Wafer 11D or 11E can be delivered through the opening of the left lateral of a chamber by this scalar type robot hand 47, and the storage shelf 55 or carrier delivery of a wafer with 22A can also be performed.
[0060] Moreover, the right edge of main part of horizontal slider 39A is approached, the sensor base 50 is installed, and 4 sets of floodlighting sections and a light sensing portion are arranged like drawing 4 on this sensor base 50. Furthermore, the adjustment base 51 is installed in the right-hand side of the sensor base 50, and the detection sensor of the notch (an orientation flat or notch) of the wafer which contains the floodlighting section 53 on the side in front of installation and the adjustment base 51 is attached for a turntable 52 on the adjustment base 51, enabling free rotation. In this example, the main part 48 of a vertical slider is located further in the right-hand side of that adjustment base 51, and Sliders 49A and 49B are attached free [sliding] in accordance with this main part 48 of a vertical slider. Moreover, the circumference exposure section containing lightguide 77 is installed between the adjustment base 51 and the main part 48 of a vertical slider. Other configurations are the same as that of the 1st example.
[0061] In this case, in this example, the wafer received by the scalar type robot hand 47 positions at the right edge of main part of horizontal slider 39A, and is installed on a turntable 52. Drawing 10 is the enlarged view of the G section in drawing 9 , as shown in this drawing 10 , detection of the center position of wafer 11J is performed by the sensor base 50 in this case, and the location of the notch of wafer 11J is detected by the notch sensor containing the floodlighting section 53. Moreover, circumference exposure of wafer 11J is performed by the circumference exposure section containing lightguide 77 if needed. Then, wafer 11J are passed to slider 49A, and are conveyed at the main part side of an aligner. According to this 2nd example, a wafer loader system is compact.
[0062] In addition, of course, configurations various in the range which this invention is not limited to the above-mentioned example, and does not deviate from the summary of this invention can be taken.
[0063]
[Effect of the Invention] According to this invention, since the main part section of an aligner and a substrate conveyance means are installed in another environmental maintenance interior of a room, there is an advantage which the probability for the dust which vibration produced when conveying a sensitization substrate with a substrate conveyance means (wafer loader system) generated with the substrate conveyance means with the pile in the exposure main part section at propagation to mix in the exposure main part section reduces.
[0064] Moreover, when a mask conveyance means is installed in the 3rd environmental maintenance room, the probability for the dust further generated with the mask conveyance means (reticle loader system) to mix in the exposure main part section decreases. furthermore, the 1- when the 3rd source of vacuum adsorption is prepared mutually-independent, there is an advantage to which adsorption of the sensitization substrate within the exposure main part section, a substrate conveyance means, and a mask conveyance means or actuation of balking does not affect other portions.
[0065] Moreover, there is an advantage which can do carrier delivery of a sensitization substrate easily, without establishing an additional device especially, since carrier delivery of external devices (the coater of sensitization material or developer) and a sensitization substrate can be performed through this substrate attaching part when a substrate conveyance means has the substrate attaching part which has two flexibility. moreover, delivery of the sensitization substrate by the additional device -- since it becomes less poor, the count of delivery of a sensitization substrate decreases, and raising dust decreases, and the reliability of conveyance actuation improves.
[0066] Moreover, when a substrate condition detection means to detect optically the location and angle of rotation of a sensitization substrate is established, the advantage which can detect the location and angle of rotation of the sensitization substrate is in a high speed, without damaging a sensitization substrate. Furthermore, locations, such as a notch of a sensitization substrate or a notch, are also easily detectable. Next, when the contact section of a substrate conveyance means and a sensitization substrate is formed from the conductive ceramics, there is an advantage to which electrification of the sensitization substrate conveyed by the substrate conveyance means decreases.
[0067] Moreover, also when the storage section of a sensitization substrate is formed from a box and the diaphragm of the sensitization substrate contained by this box and a conductive material is used as those materials, electrification of a

sensitization substrate can be prevented and adhesion of the dust between sensitization substrates etc. can be prevented. Furthermore, the gap of a sensitization substrate can fully be taken and reliability improves. Moreover, when the shelf which contains the substrate for inspection or cleaning is secured to the storage circles, the operating ratio fall of an aligner, temperature fluctuation of the environmental maintenance interior of a room, mixing from outdoor [of a very fine particle], etc. can be prevented by cleaning the conveyance side of a sensitization substrate using the substrate picked out from the storage shelf.

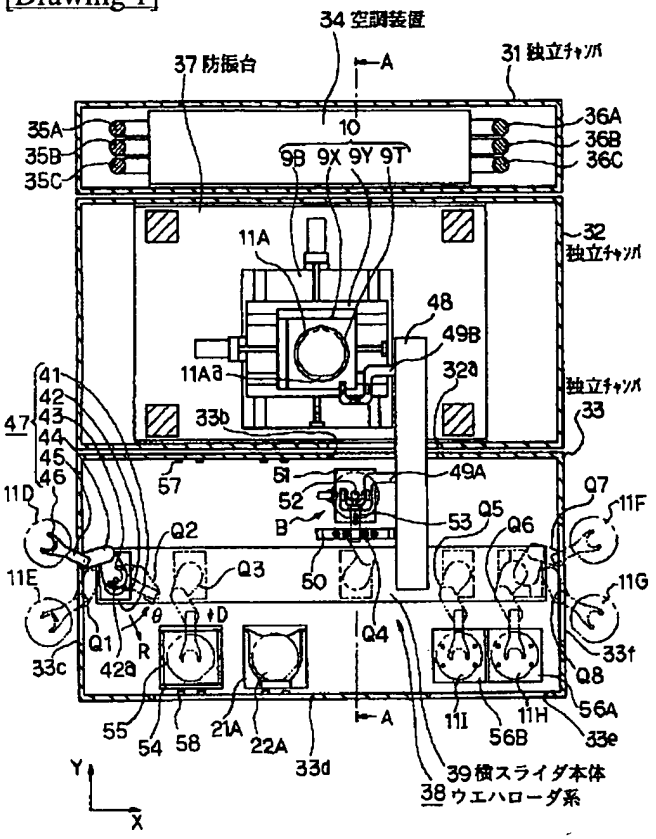
[Translation done.]

* NOTICES *

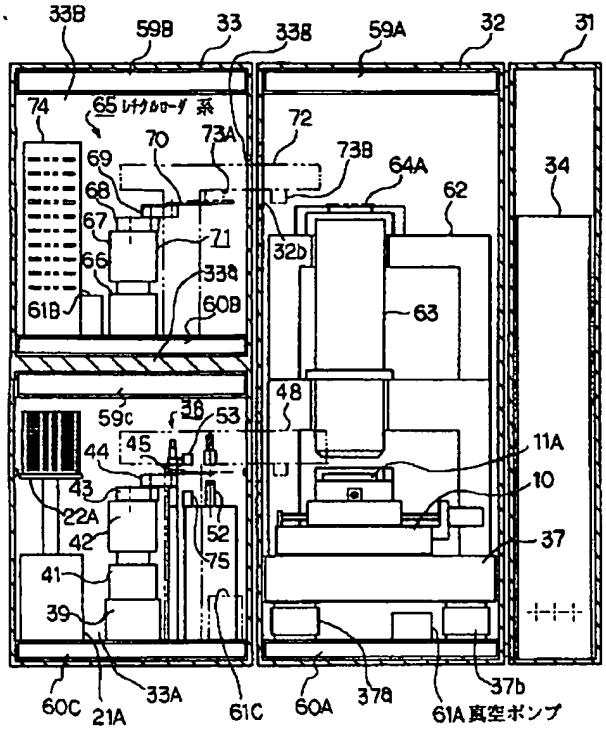
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

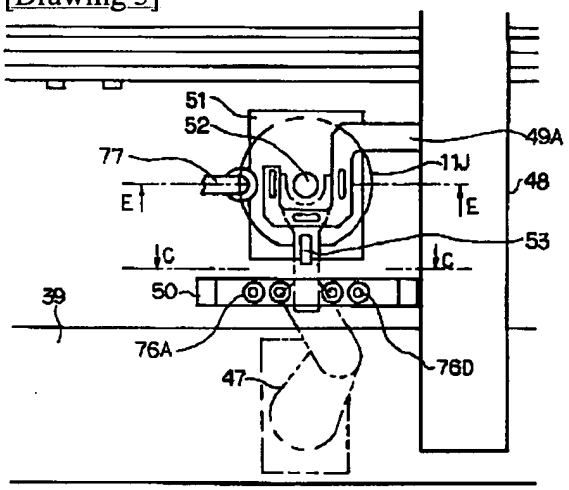
[Drawing 1]



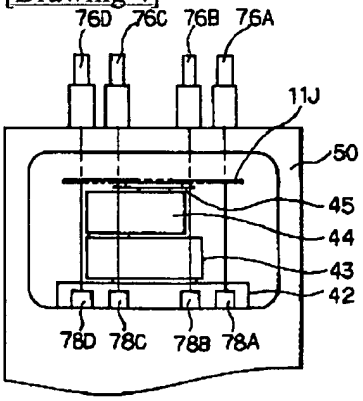
[Drawing 2]



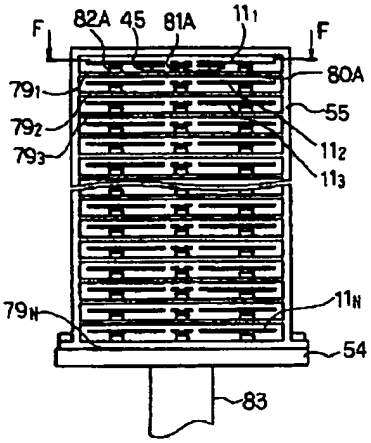
[Drawing 3]



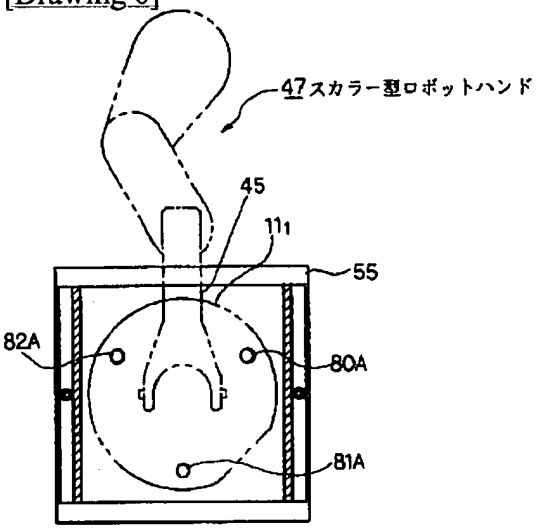
[Drawing 4]



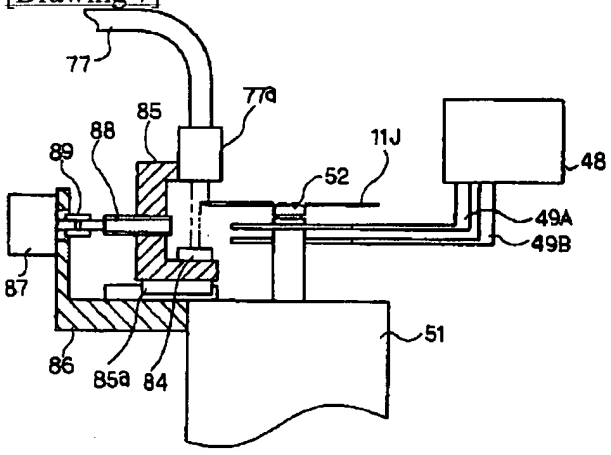
[Drawing 5]



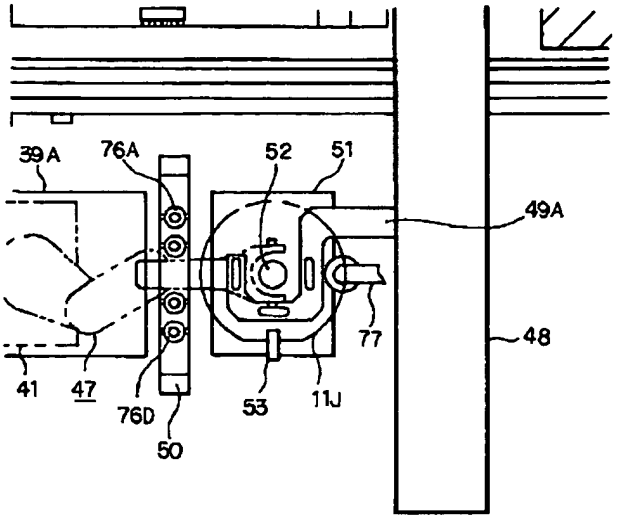
[Drawing 6]



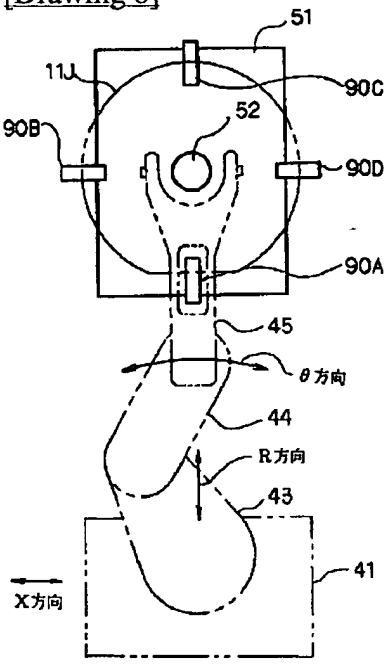
[Drawing 7]



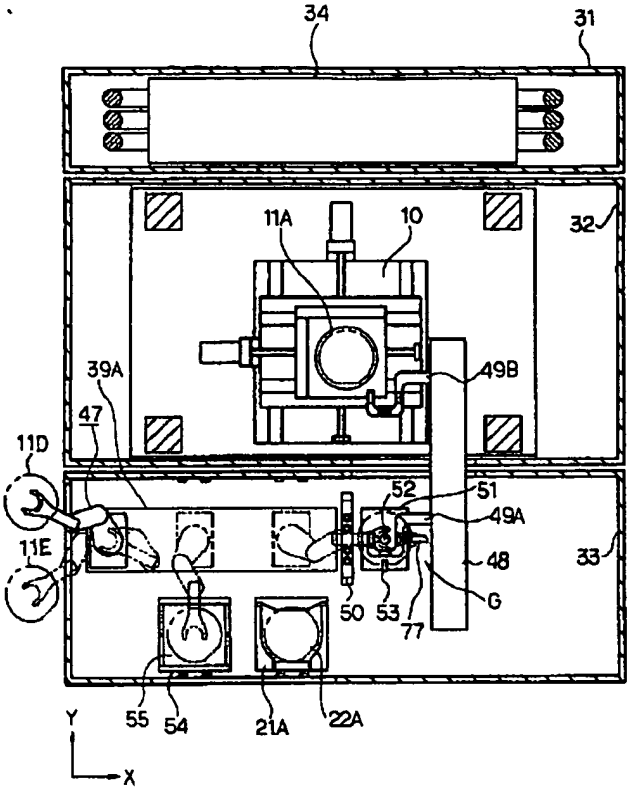
[Drawing 10]



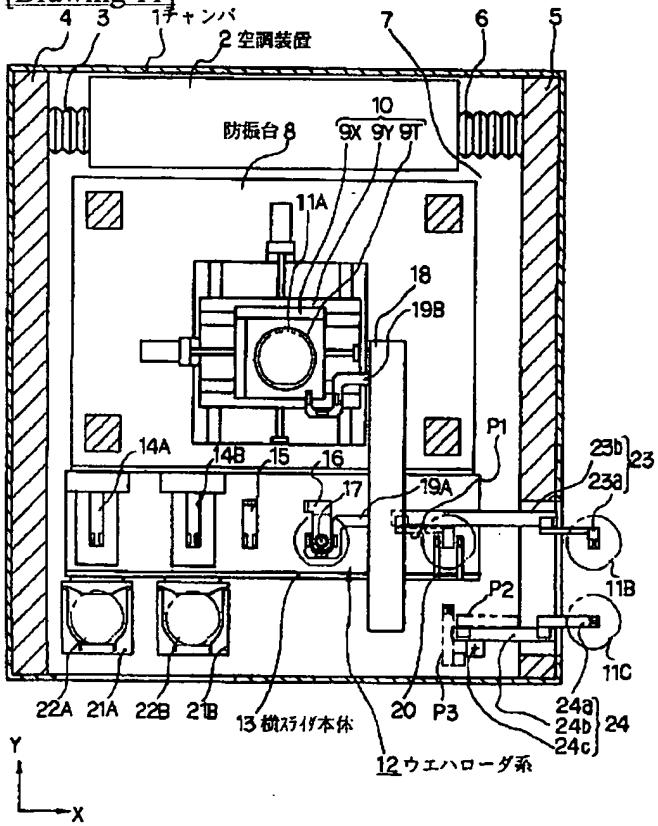
[Drawing 8]



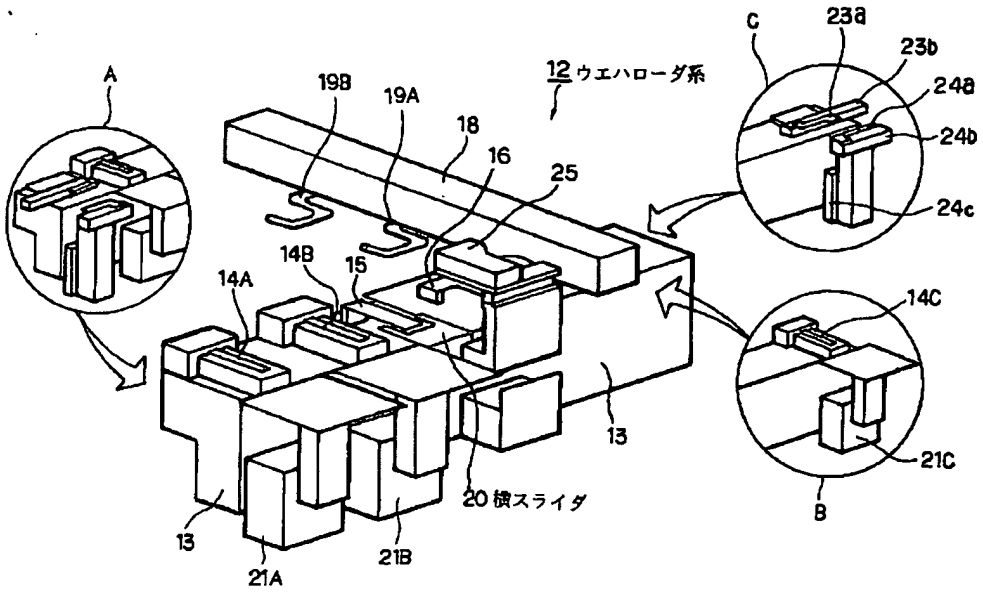
[Drawing 9]



[Drawing 11]



[Drawing 12]



[Translation done.]

* NOTICES *

CORRECTION OR AMENDMENT

[Official Gazette Type] Printing of amendment by the convention of 2 of Article 17 of patent law
[Section partition] The 2nd partition of the 7th section
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[Procedure amendment 1]
[Document to be Amended] Specification
[Item(s) to be Amended] Claim
[Method of Amendment] Modification
[Proposed Amendment]
[Claim(s)]
[Claim 1] In an aligner which exposes a pattern on a mask on a sensitization substrate conveyed continuously, respectively,
The exposure main part section which exposes said mask pattern on a sensitization substrate carried in from the outside is installed in the 1st environmental maintenance interior of a room,
While taking out an exposed sensitization substrate, it installs on the base of the 2nd environmental maintenance interior of a room which was able to establish a substrate conveyance means to perform conveyance of a sensitization substrate taken out from the storage section of a sensitization substrate, independently of said 1st environmental maintenance room,
An aligner characterized by letting a opening of the boundary section of said 1st environmental maintenance room and said 2nd environmental maintenance room pass, and said substrate conveyance means performing taking out and carrying in of a sensitization substrate to said exposure main part section.
[Claim 2] The 3rd environmental maintenance room where a mask conveyance means to perform taking out and carrying in of a mask was installed on said 2nd environmental maintenance room is accumulated,

Said 1st environmental maintenance room, the 2nd environmental maintenance room, and an air-conditioning means to perform 3rd air-conditioning of the environmental maintenance interior of a room mutually-independent are established,

An aligner according to claim 1 characterized by letting a opening of the boundary section of said 1st environmental maintenance room and said 3rd environmental maintenance room pass, and said mask conveyance means performing taking out and carrying in of a mask to said exposure main part section.
[Claim 3] The 1st source of vacuum adsorption for carrying out adsorption maintenance of said mask and said sensitization substrate in said exposure main part department in an exposure location, respectively, An aligner according to claim 1 or 2 characterized by preparing the 2nd source of vacuum adsorption for carrying out adsorption maintenance of said sensitization substrate within said substrate conveyance means at the time of conveyance, and the 3rd source of vacuum adsorption for carrying out adsorption maintenance of said mask within said mask conveyance means at the time of conveyance mutually-independent.
[Claim 4] Said substrate conveyance means centers on a predetermined shaft. Rotation ease, And a migration means to move to radial a substrate attaching part and; this substrate attaching part which have two elastic flexibility along with a predetermined guide from said predetermined shaft; It lets a opening of the boundary section of said 1st environmental maintenance room and said 2nd environmental maintenance room pass. It consists of a light transmission means which delivers and receives a sensitization substrate between said substrate attaching part and said exposure main part section and which carried out; this substrate delivery with a means by carrying out substrate delivery, and was attached to a means, and a light-receiving means. Claims 1 and 2 characterized by having a substrate condition detection means to detect a location and an angle of rotation of said sensitization substrate based on a photo-electric-conversion signal from this light-receiving means, and;, or an aligner given in three.
[Claim 5] An aligner of claim 1-4 characterized by forming the contact section of said substrate conveyance means and sensitization substrate from conductive ceramics given in any 1 term.
[Claim 6] An aligner of claim 1-5 characterized by having formed from a diaphragm which isolates at a time one sensitization substrate contained by a box and this box in the storage section of said sensitization substrate, and forming said box and said diaphragm from a conductive material, respectively given in any 1 term.
[Claim 7] An aligner according to claim 6 characterized by securing a shelf which contains a substrate for inspection or cleaning to storage circles of said sensitization substrate.
[Claim 8] An aligner according to claim 6 or 7 characterized by forming a box and a diaphragm of the storage section of said sensitization substrate with a conductive material.
[Claim 9] Claims 6 and 7 characterized by preparing three pieces or three pins or more which support said sensitization substrate on said diaphragm, or an aligner given in eight.
[Claim 10] An aligner according to claim 4 characterized by making said substrate attaching part and the contact section with said sensitization substrate in said substrate delivery means differ from the contact section with said sensitization substrate in said exposure main part section.
[Claim 11] An aligner according to claim 2 with which said mask conveyance means is characterized by performing taking out and carrying in of said mask using a scalar type robot hand.
[Procedure amendment 2]
[Document to be Amended] Specification
[Item(s) to be Amended] 0019
[Method of Amendment] Modification
[Proposed Amendment]
[0019]
[Means for Solving the Problem] In an aligner with which an aligner by this invention exposes a pattern on a mask on a sensitization substrate (11A) conveyed continuously, respectively While installing the exposure main part section (10, 62, 63) which exposes the mask pattern on a sensitization substrate (11A) carried in from the outside in the 1st environmental maintenance room (32) and taking out an exposed sensitization substrate A substrate conveyance means (38) to perform conveyance of a sensitization substrate taken out from the storage section (55) of a sensitization substrate Install on the base in the 2nd environmental maintenance room (33A) prepared independently of the 1st environmental maintenance room (32), and it lets a opening (32a, 32b) of the boundary section of the 1st environmental maintenance room (32) and the 2nd environmental maintenance room (33A) pass. The substrate conveyance means is made to perform taking out and carrying in of a sensitization substrate to the exposure main part section.
[Procedure amendment 3]
[Document to be Amended] Specification

[Item(s) to be Amended] 0020
[Method of Amendment] Modification
[Proposed Amendment]
[0020] In this case, the 3rd environmental maintenance room (33B) where a mask conveyance means (65) to perform taking out and carrying in of a mask (64A) on the 2nd environmental maintenance room (33A) was contained is accumulated. The 1st environmental maintenance room (32), the 2nd environmental maintenance room (33A), and an air-conditioning means (34) to perform air-conditioning in the 3rd environmental maintenance room (33B) mutually-independent are established. It is desirable to let the opening (32b, 33g) of the boundary section of the 1st environmental maintenance room (32) and the 3rd environmental maintenance room (33B) pass, and for a mask conveyance means (65) to perform taking out and carrying in of a mask to the exposure main part section. Moreover, in a mask conveyance means (65), it is desirable to constitute so that taking out and carrying in of a mask (64A) may be performed using a scalar type robot hand.
[Procedure amendment 4]
[Document to be Amended] Specification
[Item(s) to be Amended] 0022
[Method of Amendment] Modification
[Proposed Amendment]
[0022] Moreover, the substrate attaching part in which an example of the substrate conveyance means has two elastic flexibility from rotation ease and its predetermined shaft to radial centering on a predetermined shaft (47), The migration means to which this substrate attaching part is moved along with a predetermined guide (39) (41), It lets the opening (32a, 33b) of the boundary section of the 1st environmental maintenance room (32) and the 2nd environmental maintenance room (33A) pass. The sensitization substrate between a substrate attaching part (47) and its exposure main part section is delivered and received, and substrate delivery is carried out. A means (48, 49A, 51, 52), It consists of this light transmission means (76A- 76D, 53) and light-receiving means (78A- 78D, 75) that carried out substrate delivery and were attached to the means, and has a substrate condition detection means to detect the location and angle of rotation of that sensitization substrate based on the photo-electric-conversion signal from this light-receiving means. Moreover, it is desirable that you make it differ from a substrate attaching part (47) and the contact section with the sensitization substrate in a substrate delivery means (48, 49A, 51, 52), and the contact section with the sensitization substrate in the exposure main part section (10, 62, 63).
[Procedure amendment 5]
[Document to be Amended] Specification
[Item(s) to be Amended] 0024
[Method of Amendment] Modification
[Proposed Amendment]
[0024] Moreover, it is desirable to secure the shelf (79 Ns) which contains the substrate for inspection or cleaning in the storage section (55) of the sensitization substrate. Moreover, as for the box (55) and diaphragm (79) of the storage section of the sensitization substrate, forming with a conductive material is desirable. Moreover, in the storage section (55) of a sensitization substrate, it is desirable to support a sensitization substrate by three pieces or the pin beyond it (80A, 81A, 82A) prepared on the diaphragm (79).
[Procedure amendment 6]
[Document to be Amended] Specification
[Item(s) to be Amended] 0026
[Method of Amendment] Modification
[Proposed Amendment]
[0026] moreover, when the 3rd environmental maintenance room (33B) where a mask conveyance means (65) to perform taking out and carrying in of a mask (64A) on the 2nd environmental maintenance room (33A) was contained is accumulated vibration, dust, etc. which are generated at the time of the drive of a mask conveyance means (65) -- the exposure main part section -- propagation -- being hard -- while -- the dust within a substrate conveyance means (38), etc. the dust within a mask conveyance means (38), etc. do not have a bad influence on a partner mutually. furthermore, when the 1st environmental maintenance room (32), the 2nd environmental maintenance room (33A), and an air-conditioning means (34) to perform air-conditioning in the 3rd environmental maintenance room (33B) mutually-independent are established Generally, since the temperature precision of the gas needed with the exposure main part section, a substrate conveyance means, and a mask conveyance means, KURINNESU, and a pressure differ from a flow rate respectively, it supplies the respectively optimal gas for each part from the air-conditioning means (34). moreover,

the 1- it considers as the structure where the rigidity for which the structure of the 3rd environmental maintenance room is also needed with the exposure main part section, a substrate conveyance means, and a mask conveyance means, respectively is acquired. Moreover, in order to simplify a mask conveyance means (65), it constitutes so that taking out and carrying in of a mask (64A) may be performed using a scalar type robot hand.
[Procedure amendment 7]
[Document to be Amended] Specification
[Item(s) to be Amended] 0029
[Method of Amendment] Modification
[Proposed Amendment]
[0029] Moreover, carry out substrate delivery and it becomes a means (48, 49A, 51, 52) from a light transmission means (76A- 76D, 53) and a light-receiving means (78A- 78D, 75). When a substrate condition detection means to detect the location and angle of rotation of that sensitization substrate based on the photo-electric-conversion signal from this light-receiving means is established, this substrate condition detection means detects the center position of a sensitization substrate, the location of the notch of a sensitization substrate, etc. to high degree of accuracy by non-contact optically. In case a substrate attaching part (47) carries out substrate delivery and passes a sensitization substrate to a means (48, 49A, 51, 52) based on this detection result, the center position of this sensitization substrate is positioned to a position in a two-dimensional plane. Then, the angle of rotation of the sensitization substrate is adjusted so that the notch of the sensitization substrate may come [a carrier beam substrate delivery means] a sensitization substrate to a position, for example. Thereby, the detection equipment of the notch of the sensitization substrate of the contact process currently used conventionally and the PURIARAIMENTO devices (the device which a wafer is surfaced and is centered, or device using an X-Y stage) of a sensitization substrate become unnecessary. Moreover, the flatness of a sensitization substrate is maintained good by making a substrate attaching part (47) and the contact section with the sensitization substrate in a substrate delivery means (48, 49A, 51, 52) differ from the contact section with the sensitization substrate in the exposure main part section (10, 62, 63).
[Procedure amendment 8]
[Document to be Amended] Specification
[Item(s) to be Amended] 0064
[Method of Amendment] Modification
[Proposed Amendment]
[0064] Moreover, when a mask conveyance means is installed in the 3rd environmental maintenance room, the probability for the dust further generated with the mask conveyance means (reticle loader system) to mix in the exposure main part section decreases. furthermore, the 1- when the 3rd source of vacuum adsorption is prepared mutually-independent, there is an advantage to which adsorption of the sensitization substrate within the exposure main part section, a substrate conveyance means, and a mask conveyance means or actuation of balking does not affect other portions. Moreover, it becomes possible by performing taking out and carrying in of a mask in a mask conveyance means using a scalar type robot hand to simplify a mask conveyance means.
[Procedure amendment 9]
[Document to be Amended] Specification
[Item(s) to be Amended] 0065
[Method of Amendment] Modification
[Proposed Amendment]
[0065] Moreover, there is an advantage which can do carrier delivery of a sensitization substrate easily, without establishing an additional device especially, since carrier delivery of external devices (the coater of sensitization material or developer) and a sensitization substrate can be performed through this substrate attaching part when a substrate conveyance means has the substrate attaching part which has two flexibility. moreover, delivery of the sensitization substrate by the additional device -- since it becomes less poor, the count of delivery of a sensitization substrate decreases, and raising dust decreases, and the reliability of conveyance actuation improves. Moreover, when a substrate attaching part and the contact section with the sensitization substrate in a substrate delivery means, and the contact section with the sensitization substrate in the exposure main part section are changed, even if a foreign matter adheres to a sensitization substrate rear face by contact for a substrate attaching part and a substrate delivery means Since the foreign matter is not put between the heights on the exposure main part section, and a sensitization substrate, the flatness of a sensitization substrate is maintainable good on the exposure main part section.
[Procedure amendment 10]
[Document to be Amended] Specification

[Item(s) to be Amended] 0067
[Method of Amendment] Modification
[Proposed Amendment]
[0067] Moreover, also when the storage section of a sensitization substrate is formed from a box and the diaphragm of the sensitization substrate contained by this box and a conductive material is used as those materials, electrification of a sensitization substrate can be prevented and adhesion of the dust between sensitization substrates etc. can be prevented. Furthermore, the gap of a sensitization substrate can fully be taken and reliability improves. Moreover, when the shelf which contains the substrate for inspection or cleaning is secured to the storage circles, the operating ratio fall of an aligner, temperature fluctuation of the environmental maintenance interior of a room, mixing from outdoor [of a very fine particle], etc. can be prevented by cleaning the conveyance side of a sensitization substrate using the substrate picked out from the storage shelf. Moreover, by supporting a sensitization substrate by three pieces or the pin beyond it prepared on the diaphragm, as compared with the method which lays a sensitization substrate in shelving which has a crevice like the conventional storage section, it is weak in crystal and can avoid especially that the edge of the sensitization substrate to which a photoresist may adhere contacts the storage section in the storage section of a sensitization substrate.

[Translation done.]

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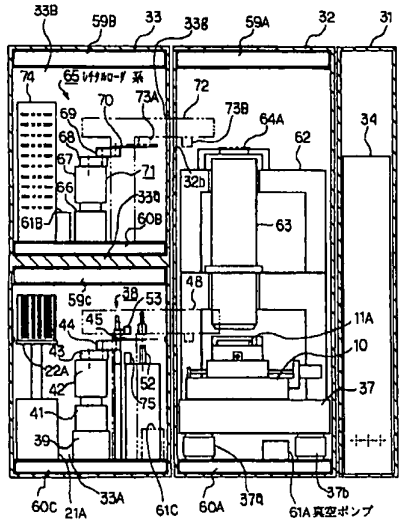
(54)【発明の名称】　露光装置

(57)【要約】

【目的】　ウエハローダ系、又はレチクルローダ系で発生した塵等が露光装置本体に混入する確率を低減させる。

【構成】　第２の独立チャンバ３２内にウエハステージ１０を含む露光装置本体部を設置し、第３の独立チャンバ３３の下部チャンバ３３Ａ内にウエハローダ系３８を設置し、独立チャンバ３３の上部チャンバ３３Ｂ内にレチクルローダ系６５を設置し、３個の空調ユニットを有する空調装置３４を用いて、独立チャンバ３２、下部チャンバ３３Ａ、上部チャンバ３３Ｂ内を独立に空調する。また、ウエハローダ系３８の縦スライダ本体４８を介して露光装置本体部とのウエハの受渡しを行う。



【特許請求の範囲】

【請求項１】　マスク上のパターンを連続的に搬送されて来る感光基板上にそれぞれ露光する露光装置において、

前記マスクパターンを外部から搬入される感光基板上に露光する露光本体部を第１の環境維持室内に設置し、

露光された感光基板を搬出すると共に、感光基板の保管部から感光基板を取り出す基板搬送手段を、前記第１の環境維持室と独立に設けられた第２の環境維持室内のベース上に設置し、

前記第１の環境維持室と前記第２の環境維持室との境界部の開口を通して、前記基板搬送手段が前記露光本体部に対して感光基板の搬出及び搬入を行うようにしたことを特徴とする露光装置。

【請求項２】　前記第２の環境維持室上に、マスクの搬出及び搬入を行うマスク搬送手段が設置された第３の環境維持室を積み重ね、

前記第１の環境維持室、第２の環境維持室、及び第３の環境維持室内の空調を互いに独立に行う空調手段を設け、

前記第１の環境維持室と前記第３の環境維持室との境界部の開口を通して、前記マスク搬送手段が前記露光本体部に対してマスクの搬出及び搬入を行うようにしたことを特徴とする請求項１記載の露光装置。

【請求項３】　前記露光本体部内で前記マスク及び前記感光基板をそれぞれ露光位置に吸着保持するための第１の真空吸着源と、前記基板搬送手段内で搬送時に前記感光基板を吸着保持するための第２の真空吸着源と、前記マスク搬送手段内で搬送時に前記マスクを吸着保持するための第３の真空吸着源と、を互いに独立に設けたことを特徴とする請求項１又は２記載の露光装置。

【請求項４】　基板搬送手段は、所定の軸を中心として回転自在、且つ前記所定の軸から半径方向へ伸縮自在な２つの自由度を有する基板保持部と；該基板保持部を所定のガイドに沿って移動させる移動手段と；前記第１の環境維持室と前記第２の環境維持室との境界部の開口を通して、前記基板保持部と前記露光本体部との間の感光基板の授受を行う基板受渡し手段と；該基板受渡し手段に付設された送光手段と受光手段とよりなり、該受光手段からの光電変換信号に基づいて前記感光基板の位置及び回転角を検出する基板状態検出手段と；を有することを特徴とする請求項１、２、又は３記載の露光装置。

【請求項５】　前記基板搬送手段と感光基板との接触部を導電性セラミックスより形成したことを特徴とする請求項１～４の何れか一項記載の露光装置。

【請求項６】　前記感光基板の保管部を、箱体と、該箱体に収納される感光基板を１枚ずつ隔離する仕切り板とより形成し、前記箱体及び前記仕切り板をそれぞれ導電性材料から形成したことを特徴とする請求項１～５の何れか一項記載の露光装置。

【請求項７】　前記感光基板の保管部内に、検査又は清掃用の基板を収納する棚を確保したことを特徴とする請求項６記載の露光装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、例えば半導体素子製造工程で使用される露光装置に関し、特に位置決め用の切欠き（オリエンテーションフラットやノッチ）を備えたウエハをウエハステージ上に搬入（ロード）すると共に、そのウエハステージからウエハを搬出（アンロード）するためのウエハローダ系を備えた露光装置に関する。

【０００２】

【従来の技術】半導体素子を製造するためのフォトリソグラフィ工程で使用されている露光装置では、フォトマスク又はレチクルのパターンを効率的に１ロットのウエハ上に露光するために、ウエハの搬入及び搬出を行うためのウエハローダ系が備えられている。更に、露光装置には、多数のレチクルの中から所望のレチクルを選択して露光位置に設定するためのレチクルローダ系も備えられている。

【０００３】図１１は、従来のウエハローダ系を備えた露光装置を示す平面図であり、この図１１において、外気からほぼ隔離されたチャンバ１内に空調装置２が備えられ、空調装置２から通気管３及び塵除去用のＨＥＰＡフィルタ（High EfficiencyParticlate Air Filter）４を介して清浄な空気がチャンバ１内にサイドフローとして吹き出され、チャンバ１内を流通した空気がリターン（排気口）５及び通気管６を介して空調装置２に戻される。

【０００４】また、チャンバ１の床７上に防振台８が設置され、この防振台８上に露光対象のウエハ１１Ａが載置されるウエハステージ１０が設置され、ウエハステージ１０は、ベース上でＹ方向に移動するＹステージ９Ｙ、Ｘ方向に移動するＸステージ、及びウエハを保持するウエハホルダ９Ｔ等から構成されている。そのウエハステージ１０の側面部に、且つ防振台８上にウエハローダ系１２が配置されている。ウエハ１１Ａの外周の一部には切欠き部（オリエンテーションフラット部又はノッチ部）が形成され、ウエハローダ系１２はその切欠き部がウエハステージ１０に対して所定の位置関係になるように、ウエハステージ１０上にウエハ１１Ａを設置（ロード）する。

【０００５】ウエハローダ系１２は基本的に、Ｘ方向に延びた横スライダ本体１３上に、Ｙ方向に延びた縦スライダ本体１８を固定して構成されている。横スライダ本体１３の側面部の２つの設置台２１Ａ及び２１Ｂ上に、それぞれプロセスウエハ用の保管棚２２Ａ及び２２Ｂが載置され、これら保管棚２２Ａ及び２２Ｂ内にこれから露光されるウエハ、又は既に露光されたウエハが保管さ

れている。

【０００６】横スライダ本体１３上には、保管棚２２Ａ内のウエハを取り出すためのランダムアクセス部（進退自在なウエハ吸着アーム）１４Ａ、保管棚２２Ｂ内のウエハを取り出すためのランダムアクセス部（進退自在なウエハ吸着アーム）１４Ｂ、ウエハ受渡し部１５、及び位置決め台１６が取り付けられ、位置決め台１６内にターンテーブル１７が植設されている。更に、横スライダ本体１３の手前側にエッジ部に沿ってＸ方向に移動自在に搬送アーム２０が配置され、縦スライダ本体１８の左側のエッジ部に沿って移動自在に２つの搬送アーム１９Ａ及び１９Ｂが設けられている。ランダムアクセス部１４Ａ、又は１４Ｂで取り出されたウエハが、搬送アーム２０によりターンテーブル１７上に搬送される。

【０００７】図１２は、図１１中のウエハローダ系１２の構成を示し、この図１２に示すように、位置決め台１６（ターンテーブル１７を含む）上に位置補正部２５が配置されている。位置補正部２５からそのターンテーブル上で回転しているウエハの外周部に接触するようにピン（不図示）が突き出され、このピンの接触状態に基づいてウエハの中心位置、及び切欠き部の位置が検出され、この検出結果に基づいてウエハの中心、及び切欠き部の位置が所定の位置に設定される。その後、ターンテーブル上のウエハが搬送アーム１９Ａによりウエハステージ側に搬送される。更に、図１２において、Ａ部は、コータ・ディベロッパーとのウエハの受渡しを行うインライン受渡しユニットを、横スライダ本体１３の左端に設けた状態を示す。インライン受渡しユニットとは、フォトレジストのコータ等から露光装置にウエハを搬入する搬送装置、又は露光装置から現像装置（ディベロッパー）等へ露光済みのウエハを搬出する搬送装置のことを言う。Ｂ部は、ウエハローダ系１２に増設用のランダムアクセス部１４Ｃ、及びウエハの保管棚を備えた設置台２１Ｃを設けた状態を示し、Ｃ部は、インライン受渡しユニットを、横スライダ本体１３の右端に設けた状態を示す。

【０００８】図１１に戻り、第１のインライン受渡しユニット２３は、アーム２３ａ及びスライド軸２３ｂよりなり、第２のインライン受渡しユニット２４は、アーム２４ａ、スライド軸２４ｂ及び回転部２４ｃよりなる。インライン受渡しユニット２３のアーム２３ａがコータ・ディベロッパー（不図示）から受け取ったウエハ１１Ｂが、位置Ｐ１で搬送アーム２０に渡される。同様に、インライン受渡しユニット２４のアーム２４ａがコータ・ディベロッパー（不図示）から受け取ったウエハ１１Ｃが、位置Ｐ２及び位置Ｐ３を経て搬送アーム２０に渡される。あるいは逆に、インライン受渡しユニット２３及び２４からコータ・ディベロッパー（不図示）に対してウエハが渡される。

【０００９】上記の従来のウエハローダ系１２において、搬送アーム２０、搬送アーム１９Ａ、搬送アーム１９Ｂ、アーム２３ａ、アーム２４ａ、ランダムアクセス部１４Ａ，１４Ｂ、位置決め台１６、及びターンテーブル１７は、それぞれアルミナセラミックス（Al_2O_3が９５％以上含まれたもの）より形成され、ウエハの保管棚２２Ａ及び２２Ｂとしては、主に実際のプロセスで用いられている樹脂性の保管棚（ウエハが２５枚入るもの）が代用されていた。

【００１０】更に、ウエハローダ系１２と共にレチクルローダ系（不図示）も防振台８上に設置されていた。レチクルローダ系では、レチクルケース内から所望のレチクルを取り出して露光位置に設置する。

【００１１】

【発明が解決しようとする課題】上記の如き従来の技術においては、防振台８上に、ウエハステージ１０と共にウエハローダ系１２及びレチクルローダ系が設置されていた。従って、ウエハローダ系１２又はレチクルローダ系でウエハ又はレチクルを搬送するときの振動がウエハステージ１０側に伝わり、ウエハステージ１０の位置決め精度が悪化する恐れがあるという不都合があった。更に、ウエハ又はレチクルを搬送する際の各アームの位置決め機構の駆動により、チャンバ１内のウエハステージ１０の周囲に塵が混入するか、又はその周囲の温度が変動することがあった。

【００１２】また、１台の空調装置２と、１組のＨＥＰＡフィルタ４及びリターン５とで、チャンバ１内の全体の空調を行うため、ウエハの露光部、ウエハローダ系１２の横スライダ本体１３、及びレチクルローダ系等においてそれぞれに必要な空調性能が得られないか、あるいはオーバスペックとなることがあった。これに関して、例えばウエハローダ系１２が露光部の風上にある場合、そのウエハローダ系１２で発生したパーティクル、又は温度変化が風下の露光部に悪影響を与えることもあった。

【００１３】更に、図１１に示すように、例えばコータ・ディベロッパーとウエハの受渡しを行う際には、専用のインライン受渡しユニット２３及び２４等を設置する必要があり、全体の構造が複雑化していた。また、ウエハをウエハステージ１０上にロードする際に、ターンテーブル１７上でウエハに対して実際にピンを接触させる方式でウエハの位置決めを行っていたため、高精度な位置決めが困難であった。そのため従来は、ウエハステージ１０上にウエハを設置した後、Ｘステージ９ＸＸ又はＹステージ９ＹＹを移動させてウエハの位置を修正するか、又はエアーフローによりウエハをウエハステージ１０から浮上させてウエハを位置決め部材に押し当てる等してウエハの再位置決めを行う必要があり、制御が複雑となり、更にはエアーフローによる発塵の問題等があった。

【００１４】また、搬送アーム２０等に、アルミナセラミックス（Al_2O_3が９５％以上）あるいは樹脂を用いていたため、ウエハあるいは搬送アームの帯電による塵の付着等の問題があった。同様に、ウエハの保管棚２２Ａ，２２Ｂもプロセス用の樹脂性のものであるため、上記の帯電による塵の付着、及び棚の変形によるウエハのアクセスミス等の問題があった。その他に、保管棚２２Ａ，２２Ｂ内のウエハのエッジ部及び裏面からレジストが脱落したときに、微細粒子がそれより下段のウエハに付着するという不都合もあった。

【００１５】これに関して、従来はウエハの搬送面及びウエハホルダ９Ｔ上のウエハとの接触面の清掃は、マニュアルで綿板円板を各接触面に軽く押し当てて滑らすことで行っており、清掃に要する時間が長かった。

【００１６】斯かる点に鑑み、本発明の第１の目的は、ウエハローダ系により順次搬送されて来るウエハ上に、それぞれレチクルのパターンを露光する露光装置において、ウエハローダ系でウエハを搬送するときに生ずる振動が露光装置本体（露光部）に伝わりにくくすると共に、ウエハローダ系で発生した塵等が露光装置本体に混入する確率を低減させることである。

【００１７】更に本発明の第２の目的は、その露光装置にレチクルローダ系を設けた場合に、このレチクルローダ系で発生した塵等が露光装置本体に混入する確率を低減させることである。また、本発明の第３の目的は、そのウエハローダ系を介して外部の装置（レジストのコータ、又は現像装置等）とウエハの受渡しを行う際に、特に付加的な機構を設けることなく、ウエハの受渡しが容易にできるようにすることである。

【００１８】また、本発明の第４の目的は、そのウエハローダ系により搬送されるウエハの帯電を減少させること、あるいは帯電したウエハの電荷を除去することであり、本発明の第５の目的は、ウエハの搬送面の清掃を行う際に、露光装置の稼働率低下、チャンバ内の温度変動、及び微細粒子の室外からの混入等を防止することである。

【００１９】

【課題を解決するための手段】本発明による露光装置は、マスク上のパターンを連続的に搬送されて来る感光基板（１１Ａ）上にそれぞれ露光する露光装置において、そのマスクパターンを外部から搬入される感光基板（１１Ａ）上に露光する露光本体部（１０，６２，６３）を第１の環境維持室（３２）内に設置し、露光された感光基板を搬出すると共に、感光基板の保管部（５５）から感光基板を取り出す基板搬送手段（３８）を、第１の環境維持室（３２）と独立に設けられた第２の環境維持室（３３Ａ）内のベース上に設置し、第１の環境維持室（３２）と第２の環境維持室（３３Ａ）との境界部の開口（３２ａ，３３ｂ）を通して、その基板搬送手段がその露光本体部に対して感光基板の搬出及び搬入を行うようにしたものである。

【００２０】この場合、第２の環境維持室（３３Ａ）上に、マスク（６４Ａ）の搬出及び搬入を行うマスク搬送手段（６５）が収納された第３の環境維持室（３３Ｂ）を積み重ね、第１の環境維持室（３２）、第２の環境維持室（３３Ａ）、及び第３の環境維持室（３３Ｂ）内の空調を互いに独立に行う空調手段（３４）を設け、第１の環境維持室（３２）と第３の環境維持室（３３Ｂ）との境界部の開口（３２ｂ，３３ｇ）を通して、マスク搬送手段（６５）がその露光本体部に対してマスクの搬出及び搬入を行うことが望ましい。

【００２１】また、その露光本体部内でマスク及び感光基板をそれぞれ露光位置に吸着保持するための第１の真空吸着源（６１Ａ）と、その基板搬送手段内で搬送時に感光基板を吸着保持するための第２の真空吸着源（６１Ｃ）と、そのマスク搬送手段内で搬送時にそのマスクを吸着保持するための第３の真空吸着源（６１Ｂ）と、を互いに独立に設けることが望ましい。

【００２２】また、その基板搬送手段の一例は、所定の軸を中心として回転自在、且つその所定の軸から半径方向へ伸縮自在な２つの自由度を有する基板保持部（４７）と、この基板保持部を所定のガイド（３９）に沿って移動させる移動手段（４１）と、第１の環境維持室（３２）と第２の環境維持室（３３Ａ）との境界部の開口（３２ａ，３３ｂ）を通して、基板保持部（４７）とその露光本体部との間の感光基板の授受を行う基板受渡し手段（４８，４９Ａ，５１，５２）と、この基板受渡し手段に付設された送光手段（７６Ａ～７６Ｄ，５３）と受光手段（７８Ａ～７８Ｄ，７５）とよりなり、この受光手段からの光電変換信号に基づいてその感光基板の位置及び回転角を検出する基板状態検出手段と、を有するものである。

【００２３】また、その基板搬送手段（３８）と感光基板との接触部を導電性セラミックスより形成することが望ましい。更に、その感光基板の保管部（５５）を、箱体（５５）と、この箱体に収納される感光基板を１枚ずつ隔離する仕切り板（79_1，79_2，…）とより形成し、その箱体及びそれら仕切り板をそれぞれ導電性材料から形成することが望ましい。

【００２４】また、その感光基板の保管部（５５）内に、検査又は清掃用の基板を収納する棚（79_N）を確保することが望ましい。

【００２５】

【作用】斯かる発明によれば、２つの環境維持室（３２，３３Ａ）が独立に設けられ、第１及び第２の環境維持室内にそれぞれ独立に露光本体部（１０，６２，６３）及び基板搬送手段（３８）が設置され、基板搬送手段はそれら２つの環境維持室の境界部の開口を通して感光基板の受渡しを行う。従って、基板搬送手段を介して感光基板を搬送する際に発生する振動、又は塵等が露光本体部に伝わりにくくなっている。

【００２６】また、第２の環境維持室（３３Ａ）上に、

マスク（６４Ａ）の搬出及び搬入を行うマスク搬送手段（６５）が収納された第３の環境維持室（３３Ｂ）を積み重ねた場合には、マスク搬送手段（６５）の駆動時に発生する振動や塵等が露光本体部に伝わりにくいと共に、基板搬送手段（３８）内の塵等とマスク搬送手段（３８）内の塵等とが互いに相手に悪影響を与えない。更に、第１の環境維持室（３２）、第２の環境維持室（３３Ａ）、及び第３の環境維持室（３３Ｂ）内の空調を互いに独立に行う空調手段（３４）を設けた場合には、一般に、露光本体部、基板搬送手段、及びマスク搬送手段で必要とされる気体の温度精度、クリーンネス、圧力、流量は各々異なるため、その空調手段（３４）から各部にそれぞれ最適な気体を供給する。また、第１～第３の環境維持室の構造も、それぞれ露光本体部、基板搬送手段、及びマスク搬送手段で必要とされる剛性が得られる構造とする。

【００２７】次に、その露光本体部内でマスク及び感光基板をそれぞれ露光位置に吸着保持するための第１の真空吸着源（６１Ａ）と、その基板搬送手段内で搬送時に感光基板を吸着保持するための第２の真空吸着源（６１Ｃ）と、そのマスク搬送手段内で搬送時にそのマスクを吸着保持するための第３の真空吸着源（６１Ｂ）と、を互いに独立に設けた場合、例えば基板搬送手段内で感光基板の吸着又は分離を行っても、その影響が露光本体部及びマスク搬送手段側に伝わらない。また、露光本体部で真空吸着源（６１Ａ）に圧力変動が伝わると、マスク又は感光基板の位置ずれの恐れがあるが、本発明では真空吸着源（６１Ａ）が独立であるためそれらの位置ずれが起こらない。

【００２８】更に、その基板搬送手段が、所定の軸を中心として回転自在、且つその所定の軸から半径方向へ伸縮自在な２つの自由度を有する基板保持部（４７）と、この基板保持部を所定のガイド（３９）に沿って移動させる移動手段（４１）とを有する場合、２つの自由度を有する基板保持部（４７）が別設の外部装置（感光材のコータ、又は現像装置等）との感光基板の受渡しを行う。その外部装置が基板搬送手段に対して、左右又は前方等の何れから接近して配置されても、その基板保持部（４７）により感光基板の受渡しを行うことができる。また、従来のように別途設けたインライン受渡しユニットを使用する必要がないため、感光基板の受渡しの回数が減少し、発塵の可能性が低下し、動作の信頼性が向上する。

【００２９】また、基板受渡し手段（４８，４９Ａ，５１，５２）に、送光手段（７６Ａ～７６Ｄ，５３）と受光手段（７８Ａ～７８Ｄ，７５）とよりなり、この受光手段からの光電変換信号に基づいてその感光基板の位置及び回転角を検出する基板状態検出手段を設けた場合には、この基板状態検出手段により、光学的に非接触で感光基板の中心位置、及び感光基板の切欠き部の位置等を高精度に検出する。この検出結果に基づいて、基板保持部（４７）が基板受渡し手段（４８，４９Ａ，５１，５２）に感光基板を渡す際に、この感光基板の中心位置を２次元平面内で所定の位置に位置決めする。その後、感光基板を受けた基板受け渡し手段が、例えばその感光基板の切欠き部が所定の位置に来るようにその感光基板の回転角を調整する。これにより、従来使用されていた接触式の感光基板の切欠き部の検出装置、及び感光基板のプリアライメント機構（ウエハを浮上させてセンタリングする機構、あるいはＸＹステージを用いた機構等）が不要となる。

【００３０】また、感光基板の中心位置、及び切欠き部の位置が高精度に検出されるため、その感光基板をその中心を軸として容易に回転させることができる。そこで、その回転中の感光基板の周縁部に、投光手段を介してその感光基板を露光させる露光光と同じ波長帯の光を照射してもよい。これにより、感光基板の周縁部のみを露光する所謂周辺露光が可能となる。周辺露光は、感光基板の周縁部が未露光の場合に、現像等の処理後にその周縁部から塵等が発生するのを防止するために行われる。周辺露光による感光基板上での露光幅は、回転中の感光基板の中心の位置合わせ精度によってばらつくことになる。このばらつきを小さくしたい場合には、その投光手段、又は感光基板の回転手段をその感光基板の回転位置に応じてその感光基板の半径方向に移動させればよい。

【００３１】更に、基板搬送手段（３８）の感光基板との接触部を例えば緻密な表面を持つ導電性セラミックスを用いて形成した場合には、①感光基板とのひっかかりが小さくなり発塵が少なくなる、②その接触部及び感光基板の帯電が回避されて集塵作用が低減される、③帯電した感光基板の静電気が除去されて感光基板の静電破壊が防止されると共に、感光基板の集塵作用が低減される、④その接触部が緻密なことにより、パーティクル（微細粒子）付着時のアンカー効果（引きずり効果）が低減され、清掃が容易になる、等の作用効果を奏する。従って、感光基板の裏面、又は表面へのパーティクルの付着の可能性が低減され、露光時の歩留りの向上が期待できる。

【００３２】次に、感光基板の保管部（５５）の箱体（５５）、及び仕切り板を導電性材料から形成した場合にも、その保管部（５５）及び感光基板での集塵作用が低減されて、露光時の歩留まりが向上する。更に、仕切り板を設けたことにより、上段の感光基板の裏面あるいはエッジ部より発生する塵が脱落して下段の感光基板の表面に付着することが回避される。また、それら仕切り板上に設けられた例えば３個（あるいはそれ以上）のピン上に感光基板を設置するようにした場合には、従来の保管部のように隙間のある棚上に感光基板を載置する方式と比較して、特に結晶的にもろく、フォトレジストが付着する可能性のある感光基板のエッジが保管部（５５）に接触することが回避できる。

【００３３】また、感光基板の保管部（５５）内に、検査又は清掃用の基板を収納する棚（７９$_n$）を確保した場合には、通常の露光用の感光基板の枚数を例えば２５×Ｎ（Ｎは０以上の整数）枚とすると、その保管部（５５）には、（２５×Ｎ＋１）枚の感光基板が収納可能となる。例えば基板搬送手段（３８）の清掃時には、その保管部（５５）からその検査又は清掃用の基板を基板搬送手段（３８）内に取り込み、その基板搬送手段（３８）内で移動させた後、再びその保管部（５５）に戻すようにする。これにより、環境維持室（３３Ａ）を隔閉してマニュアルで清掃用の基板をセット又は取り出すことにより清掃を行う場合と比べて、塵の混入、温度変化等が回避される。それにより、清掃の回数を減らすこともできる。これにより、露光装置の稼働率の向上が計れる。

【００３４】

【実施例】以下、本発明による露光装置の第１実施例につき図面を参照して説明する。図１は、本実施例の露光装置のチャンバの平面断面図であり、この図１において、互いに独立な３つの独立チャンバ３１，３２及び３３を並べて配置する。図２は、図１のＡＡ線に沿う断面図であり、この図２に示すように、第３の独立チャンバ３３を、仕切り板３３ａにより、下部チャンバ３３Ａと上部チャンバ３３Ｂとに分離する。

【００３５】第１の独立チャンバ３１内には、３つの互いに独立に動作する空調ユニットよりなる空調装置３４を設置し、空調装置３４内の第１の空調ユニットで温度調整された空気を、第１の配管３５Ａ、及び図２の第２の独立チャンバ３２の天井に設置された塵除去用のＨＥＰＡフィルタ５９Ａを介してその独立チャンバ３２内に吹き出させ、独立チャンバ３２の床に設置されたリターン６０Ａ、及び第１の配管３６Ａを介してその第１の空調ユニットに戻す。また、空調装置３４内の第２及び第３の空調ユニットで温度調整された空気を、それぞれ第２の配管３５Ｂ、及び第３の配管３５Ｃを介して、図２の第３の独立チャンバ３２の下部チャンバ３３Ａの天井に設置されたＨＥＰＡフィルタ５９Ｃ、及び上部チャンバ３３Ｂの天井に設置されたＨＥＰＡフィルタ５９Ｂに導く。そして、ＨＥＰＡフィルタ５９Ｃから下部チャンバ３３Ａにダウンフローしてリターン６０Ｃに達した空気、及びＨＥＰＡフィルタ５９Ｂから上部チャンバ３３Ｂにダウンフローしてリターン６０Ｂに達した空気を、それぞれ第２の配管３６Ｂ及び第３の配管３６Ｃを介して第２及び第３の空調ユニットに戻す。

【００３６】なお図示していないが、露光装置本体及びウエハローダ系等を設置する独立チャンバ３２，３３Ａ，３３Ｂ内に存在するイオン（例えばNH_4^+，SO_4^{2-}）、二酸化硫黄（SO_2）等の進入を防止するケミカルフィルタをＨＥＰＡフィルタ５９Ａ～５９Ｃと一緒に設けるとよい。これにより、硫酸アンモニウム（$(NH_4)_2SO_4$）等が生成されて照明光学系を構成する光学素子に付着してその反射率又は透過率を低下させる現象、及びレジストパターンの断面形状がＴ字状になる現象の発生を防止できる。このケミカルフィルタは３つのＨＥＰＡフィルタ５９Ａ～５９Ｃの各々に対応して設ければよい。但し、少なくともＨＥＰＡフィルタ５９Ａにはケミカルフィルタを設けるようにして、他のＨＥＰＡフィルタ５９Ｂ，５９Ｃにはケミカルフィルタを設けないようにしてもよい。

【００３７】図２において、第２の独立チャンバ３２内には露光装置本体を設置する。即ち、独立チャンバ３２の床上には防振パッド３７ａ及び３７ｂを介して防振台３７を設置し、防振台３７上にウエハステージ１０を設置し、露光時にはウエハステージ１０上にフォトレジストが塗布されたウエハ１１Ａをロードする。防振台３７上にコラム６２を植設し、コラム６２の中段に投影光学系６３を固定し、コラム６２の上端部のレチクルホルダ上に露光対象とするレチクル６４Ａを載置する。

【００３８】図１に戻り、ウエハステージ１０は、ベース９Ｂ、Ｙステージ９Ｙ、Ｘステージ９Ｘ、及びウエハホルダ９Ｔ等から構成され、ウエハホルダ９Ｔ上に露光対象のウエハ１１Ａが真空吸着により保持される。ウエハ１１Ａの円形の外周の一部にオリエンテーションフラット（又はノッチ）と呼ばれる切欠き部が形成されており、この切欠き部が所定の方向を向くように、且つウエハ１１Ａの中心がウエハホルダ９Ｔに対して所定の位置関係になるように、ウエハホルダ９Ｔ上にウエハ１１Ａをロードする。本実施例では、そのウエハホルダ９Ｔ上へのウエハの搬入（ロード）、及びそのウエハホルダ９Ｔからのウエハの搬出（アンロード）を行うためのウエハローダ系３８を、第３の独立チャンバ３３の下部チャンバ３３Ａ（図２参照）内の床上に設置する。

【００３９】ウエハローダ系３８のガイド部を、Ｘ方向に延びた横スライダ本体３９、及びＹ方向に延びた縦スライダ本体４８より構成し、横スライダ本体３９上にＸ方向に摺動自在にスカラー型ロボットハンド４７を配置する。スカラー型ロボットハンド４７は、横スライダ本体３９に沿ってＸ方向に移動するＸ軸移動部４１、このＸ軸移動部４１上でＸＹ平面に垂直なＺ方向に伸縮するＺ軸移動部４２、このＺ軸移動部４２の中心４２ａを軸として回転するθ軸回転部４３、このθ軸回転部４３の先端に回転自在に設けられたＲ軸回転部４４、このＲ軸回転部４４の先端に回転自在に設けられたハンド部４５より構成し、ハンド部４５の先端部に真空吸着部４６を取り付ける。θ軸回転部４３を中心４２ａを軸として回転することにより、ハンド部４５はθ方向に回転し、Ｒ軸回転部４４及びハンド部４５の回転角を組み合わせることにより、ハンド部４５の中心４２ａから半径方向

（Ｒ方向）への位置を調整できる。

【００４０】また、横スライダ本体３９の側面部に設置された設置台２１Ａ及び５４上にそれぞれウエハを保管するための保管棚２２Ａ及び５５を固定し、更にウエハを一次的に載置するためのウエハの仮置き台５６Ａ及び５６Ｂを設置する。仮置き台５６Ａ及び５６Ｂ上には、ウエハ載置用の複数個（図１では４個）のピンを植設する。保管棚２２Ａ及び５５の近傍、並びに仮置き台５６Ａ及び５６Ｂの近傍の独立チャンバ３３の側面には、それぞれ外部から保管棚等を交換するための開口３３ｄ及び３３ｅを設ける。スカラー型ロボットハンド４７のハンド部４５を独立チャンバ３３の左側面の開口３３ｃから突き出すことにより、外部装置（外部のフォトレジストのコータ、又は現像装置等）に対するウエハ１１Ｄの受け渡しを行うことができ、別の位置Ｑ１でもウエハ１１Ｅの受け渡しを行うことができる。更に、スカラー型ロボットハンド４７を位置Ｑ７に移動させて、独立チャンバ３３の右側面の開口３３ｆからハンド部を突き出すことにより、外部装置とのウエハ１１Ｆの受け渡しを行うことができ、別の位置Ｑ８でもウエハ１１Ｇの受け渡しを行うことができる。同様に、スカラー型ロボットハンド４７を位置Ｑ３、Ｑ５、又はＱ６に移動することにより、それぞれ保管棚５５、仮置き台５６Ａ又は仮置き台５６Ｂに対するウエハの受け渡しを行うことができる。

【００４１】また、縦スライダ本体４８は、独立チャンバ３２の側面の開口３２ａ及び独立チャンバ３３の下部チャンバ３３Ａの側面の開口３３ｂを通して独立チャンバ３２内に突き出ており、縦スライダ本体４８の側面に長手方向に摺動自在に、ウエハとの接触部がコの字型の２個のスライダ４９Ａ及び４９Ｂを取り付ける。これら２個のスライダ４９Ａ及び４９Ｂは、それぞれ真空吸着によりウエハを保持した状態で、独立チャンバ３２内と下部チャンバ３３Ａ内との間を独立に移動する。そして、スカラー型ロボットハンド４７は例えば保管棚５５からウエハを取り出した後、位置Ｑ４において、上下動可能なターンテーブル５２を介してスライダ４９Ａ又は４９Ｂにウエハを渡す。その後、スライダ４９Ａ又は４９Ｂから露光後のウエハを同様にターンテーブル５２の上下動を介して受け取ったスカラー型ロボットハンド４７は、そのウエハを例えば保管棚５５に戻す。

【００４２】また、スカラー型ロボットハンド４７のハンド部４５、スライダ４９Ａ、スライダ４９Ｂのようにウエハと接触する部分は、表面が緻密な導電性セラミックスより形成する。但し、そのウエハとの接触部の表面に緻密な導電性セラミックスをコーティング等により被着してもよい。次に、横スライダ本体３９と縦スライダ本体４８とが交差する領域付近、即ち位置Ｑ４の近傍に、センサ台５０を設置し、このセンサ台５０にウエハの中心位置を検出するための中心位置センサ（後述）を配置する。センサ台５０の上側に調整台５１を配置し、調整台５１の上部にＸＹ平面に垂直な軸を中心として回転する導電性セラミックス製のターンテーブル５２を設け、この調整台５１上で且つターンテーブル５２とセンサ台５０との間の位置に、ウエハの外周部の直線状の切欠き部（オリエンテーションフラット）の位置を検出するための切欠き検出センサの投光部５３、及び１次元ＣＣＤ等からなるラインセンサ７５（図２参照）を配置する。投光部５３は、ウエハ上のフォトレジストに対して非感光性のスリット状の光ビームをラインセンサ７５に照射し、ラインセンサ７５は、そのスリット状の光ビームの内の遮光された部分の長さを検出し、検出結果を不図示の制御系に供給する。

【００４３】図３は、図１中のＢ部の拡大図であり、この図３において、スカラー型ロボットハンド４７からターンテーブル５２上にウエハ１１Ｊを渡すときに、ウエハ１１Ｊは先ずセンサ台５０の中を通過する。図３のＣＣ線に沿う断面図である図４に示すように、センサ台５０の上部には４個の投光部７６Ａ～７６Ｄを設置し、センサ台５０の下部には投光部に対向するように４個の受光部７８Ａ～７８Ｄを設置しておき、ウエハ１１Ｊにはそれら投光部７６Ａ～７６Ｄと受光部７８Ａ～７８Ｄとの間を通過させる。投光部７６Ａ～７６Ｄからは、ウエハ上のフォトレジストに対して非感光性のビーム状の照明光が射出される。

【００４４】この場合、図３に示すように、ウエハ１１Ｊはほぼ円形であるため、ウエハ１１Ｊのターンテーブル５２方向への位置と、図４の受光部７８Ａ～７８Ｄのそれぞれでウエハ１１Ｊにより光が遮光されてから再び光が受光されるまでのタイミングとの関係から、不図示の制御系によりウエハ１１の中心位置を求める。そして、スカラー型ロボットハンド４７は、ウエハ１１Ｊの中心位置がターンテーブル５２の回転中心に合致するように、ターンテーブル５２上にウエハ１１Ｊを載置する。この際にウエハ１１Ｊの裏面にスライダ４９Ａを移動させておく。また、前記中心位置情報に基づいて、スカラー型ロボットハンド４７のＲ軸の制御及びθ軸（あるいはＸ軸）の制御を行うことにより、ウエハ１１Ｊは中心が合致するようにターンテーブル５２上に載置される。ターンテーブル５２上でウエハ１１Ｊは真空吸着される。このような位置決め方式により、ほぼ±０．２ｍｍ程度の精度でターンテーブル５２の中心に対してウエハの中心が位置決めされる。

【００４５】その状態でターンテーブル５２を回転させると、ウエハ１１Ｊの周縁部が切欠き検出センサの投光部５３とラインセンサ７５（図２参照）との間で回転し、ウエハ１１Ｊの切欠き部（オリエンテーションフラット又はノッチ）がラインセンサ７５上を通過する際に遮光部の長さが減少することから、不図示の制御系がそのウエハ１１Ｊの切欠き部の位置を検出する。この検出結果に応じて、ウエハ１１Ｊの切欠き部が例えば横スライダ本体３９に対向する位置でターンテーブル５２の回転を停止する。その後、ターンテーブル５２によるウエハ１１Ｊの吸着を解除し、ターンテーブル５２が下降して、スライダ４９Ａの上面にウエハ１１Ｊを真空吸着して、そのスライダ４９Ａを縦スライダ本体４８に沿って図１の独立チャンバ３２側に移動させ、不図示のウエハ受渡し手段（例えばウエハホルダ９Ｔ内に設けられ、上下動（図１の紙面と垂直な方向に）可能な、表面に真空吸着用の溝が形成された可動ピンである）によりそのスライダ４９Ａからウエハホルダ９Ｔ上にウエハ１１Ｊを移す。この際に、ウエハ１１Ｊの中心及び切欠き部の位置が正確に所定の状態になってウエハ１１Ｊがウエハホルダ９Ｔ上に載置される。

【００４６】更に、ウエハホルダ９Ｔ上には一般に同心円状の凸部があり、これら同心円状の凸部上にウエハ１１Ｊが載置される。そこで、スカラー型ロボットハンド４７、及びスライダ４９Ａ，４９Ｂにおけるそのウエハ１１Ｊとの接触部は、そのウエハホルダ９Ｔ上での接触部と異ならしめることが望ましい。すなわち、スカラー型ロボットハンド４７、及びスライダ４９Ａ，４９Ｂと接触するウエハ裏面の位置と、ウエハホルダ９Ｔの凸部と接触するウエハ裏面の位置とを異ならしめる。このとき、ウエハホルダ９Ｔの凸部の形状に応じて、スカラー型ロボットハンド４７、及びスライダ４９Ａ，４９Ｂのウエハとの接触部の位置、面積を決めればよい。これにより、ウエハホルダ９Ｔ上でのウエハの平面度を良好に維持できる。これはウエハ裏面にスカラー型ロボットハンド４７、及びスライダ４９Ａ，４９Ｂとの接触によって異物が付着しても、その異物がウエハホルダ９Ｔの凸部とウエハとの間に挟み込まれることがないためである。

【００４７】なお、図２のラインセンサ７５の代わりに、シリンドリカルレンズと１個の受光素子（例えばフォトダイオード）とを組合せたアナログセンサを使用してもよい。このアナログセンサを使用すると、ウエハによる遮光部の長さに応じてその受光素子の受光量が変化することから、その遮光部の長さを検出できる。また、ウエハの円周方向の２箇所に、投光部５３とアナログセンサとの組合せを２組配置し、２個のアナログセンサの出力信号のバランスが取れるようにサーボ方式でターンテーブル５２の回転位置を固定することによって、ウエハ１１Ｊの切欠き部（オリエンテーションフラット又はノッチ）の位置決めを行ってもよい。

【００４８】図３に戻り、調整台５１の上方に、レチクルを照明するための露光光の一部を分離して得られた光を導く光ガイド７７を配置する。図７は、図３のＥＥ線に沿う断面図であり、この図７に示すように、光ガイド７７の射出端７７ａをコの字型の移動台８５の上端部に取り付け、移動台８５の下端部にその射出端７７ａに対向するように１次元ＣＣＤよりなるラインセンサ８４を固定し、移動台８５の底面に固定されたスライダ８５ａを、調整台５１に固定された支持台８６上のガイド部に設置する。支持台８６には駆動モータ８７を固定し、移動台８５の側面部にスライダ８５ａの摺動方向と平行に送りねじ８８を螺合し、駆動モータ８７の回転軸にカップリング８９を介してその送りねじ８８を結合する。移動台８５の移動方向は、ターンテーブル５２を中心とした半径方向であり、駆動モータ８７を駆動することにより、移動台８５をその半径方向に沿って移動させることができる。

【００４９】そして、所謂周辺露光時には、光ガイド７７の射出端７７ａから、ターンテーブル５２上に吸着されているウエハ１１Ｊの周縁部に、ウエハ１１Ｊ上に塗布されたフォトレジストを感光させるスリット状の露光光を照射し、ラインセンサ８４では、その露光光の遮光部の長さを検出し、この検出結果を不図示の制御系に供給する。周辺露光とは、ウエハ１１Ｊの周縁部からの発塵を防止するために、ウエハ１１Ｊの周縁部のフォトレジストのみを感光させることを言う。この場合、本実施例では、ターンテーブル５２の回転中心とウエハ１１Ｊの中心とがほぼ正確に合致しているため、移動台８５の位置を調整して射出端７７ａから露光光を射出させることにより、ウエハ１１Ｊの周辺露光の幅を所望の値に正確に設定できる。また、ウエハの切欠き位置が既知のため、ターンテーブル５２にエンコーダ付モータ又はステッピングモータを採用して、ウエハ１１Ｊの切欠き部が射出端７７ａとラインセンサ８４との間に達したときには、周辺露光の幅が一定になるように移動台８５の位置を調整することにより、ウエハ１１Ｊの切欠き部でも一定の幅で周辺露光を行うことができる。

【００５０】図２に戻り、独立チャンバ３３の上部チャンバ３３Ｂ内のリターン６０Ｂ上にレチクルローダ系６５を設置する。レチクルローダ系６５のガイド部は、独立チャンバ３２の開口３２ｂ及び上部チャンバ３３Ｂの開口３３ｇを通して独立チャンバ３２内に突き出た縦スライダ本体７２より構成され、縦スライダ本体７２に沿って摺動自在に２つのスライダ７３Ａ及び７３Ｂが取り付けられている。そして、縦スライダ本体７２の支持台の近傍に、ベース６６、このベース６６上でＸＹ平面に垂直なＺ方向に伸縮するＺ軸移動部６７、このＺ軸移動部６７の中心を軸として回転するθ軸回転部６８、このθ軸回転部６８の先端に回転自在に設けられたＲ軸回転部６９、このＲ軸回転部６９の先端に回転自在に設けられたハンド部７０よりなるスカラー型ロボットハンドを設置する。

【００５１】また、そのレチクル用のスカラー型ロボットハンドの近傍にレチクル用の保管棚７４を設置し、保管棚７４からそのスカラー型ロボットハンドのハンド部７０で真空吸着によりレチクルを取り出し、このように

取り出したレチクルを縦スライダ本体のスライダ７３Ａ又は７３Ｂに渡す。その後、スライダ７３Ａ又は７３Ｂはレチクルを真空吸着により保持した状態で、縦スライダ本体７２に沿って独立チャンバ３２内に移動し、不図示のレチクル受渡し手段を介して露光装置本体部のコラム６２上のレチクルホルダ上にそのレチクルを設置する。また、レチクルを交換する際には、そのレチクルホルダから取り出されたレチクルが、スライダ７３Ａ又は７３Ｂ、及びレチクル用のスカラー型ロボットハンドを介して保管棚７４に戻される。このようにレチクルの搬送時にもスカラー型ロボットハンドが使用されているため、レチクルローダ系６５が簡略化されている。

【００５２】更に図２において、第２の独立チャンバ３２、第３の独立チャンバ３３の下部チャンバ３３Ａ、及び上部チャンバ３３Ｂ内にはそれぞれ真空ポンプ６１Ａ，６１Ｃ及び６１Ｂを設置し、真空ポンプ６１Ａで、独立チャンバ３２内の露光装置本体での真空吸着用の負圧を供給し、真空ポンプ６１Ｃで、チャンバ３３Ａ内のウエハローダ系３８での真空吸着用の負圧を供給し、真空ポンプ６１Ｂで、チャンバ３３Ｂ内のレチクルハローダ系６５での真空吸着用の負圧を供給する。このように本実施例では、露光装置本体での真空吸着、ウエハローダ系３８での真空吸着、及びレチクルローダ系６５での真空吸着が独立に行われるため、互いにウエハの吸着又は離脱時の影響が伝わらない利点がある。また、独立チャンバ３２内の露光装置本体のウエハホルダ９Ｔ上に吸着されたウエハにレチクルパターンを露光している間に、ウエハローダ系３８、又はレチクルローダ系６５で真空吸着のオン又はオフを行っても、ウエハホルダ９Ｔ側では圧力変動がないため、ウエハが位置ずれしないという利点もある。

【００５３】次に、図１中の保管棚５５の構成につき図５及び図６を参照して詳細に説明する。図５は、図１の矢視Ｄ方向から見た図であり、この図５に示すように、保管棚５５は、導電性材料からなる箱体であり、前後が抜けた構造となっている。また、その箱体の天板と底板７９$_N$との間に、順に導電性材料からなる仕切り板７９$_1$，７９$_2$，…がその箱体と一体に装着されている。これにより、保管棚５５内にはＮ枚のウエハを格納でき、Ｎ枚の一例は１以上の整数ｎを用いて、（２５×ｎ＋１）枚、即ち、２６枚、５１枚、７６枚等である。あるいはｎ＝０の場合は、Ｎ枚は１枚である。

【００５４】また、保管棚５５は、設置台５４上にねじ止めにより固定し、保管棚５５内の仕切り板７９$_1$上には３個の導電性セラミックス製のピン８０Ａ，８１Ａ，８２Ａを植設する。同様に、他の仕切り板７９$_2$，７９$_3$，…及び底板７９$_N$上にもそれぞれ３個の導電性セラミックス製のピンを植設する。例えば１ロットのウエハへの露光を行う際には、仕切り板７９$_1$，７９$_2$，…，底板７９$_N$上にはそれぞれウエハ１１$_1$，１１$_2$，…，１１$_N$が設置されている。そして、例えばウエハ１１$_1$を保管棚５５から搬出する際には、図５のＦＦ線に沿う断面図である図６に示すように、スカラー型ロボットハンド４７のハンド部４５をウエハ１１$_1$の裏面と仕切り板７９$_1$との間に差し込んで、そのウエハ１１$_1$を取り出す。

【００５５】この場合、本実施例では、通常の露光時の１ロットのウエハの枚数は２５×ｎ枚であるため、本実施例の保管棚５５には更に１枚多いウエハを保管できる。但し、余分に保管できるウエハの枚数を複数枚にしてもよい。その余分に保管できる部分には、例えばウエハホルダ９Ｔ（図１参照）上の平面度計測用の高平面度の基準ウエハ、装置の自己計測用のマスタウエハ、又はウエハの接触部清掃用のウエハ等を保管する。本実施例では、このように余分に収納できる空間を保管棚５５の一部に確保しているが、例えば図１の仮置き台５６Ａ，５６Ｂのような独立した台を用いてもよい。

【００５６】次に、本実施例の保管棚５５は、前後が抜けているため、前後からの検査用の光を通過させることができる。そこで、図１に示すように、チャンバの内側面に保管棚５５を挟むように投光器５７及び受光器５８を配置する。そして、保管棚５５内にウエハが無いときには、投光器５７から射出された光ビームが保管棚５５内を通過して受光器５８で受光され、ウエハがあるときにはその光ビームが遮光されるようにする。これにより、保管棚５５内のウエハの有無をチェックできる。更に保管棚５５の後方に壁があっても透明体であれば本機能は達成できる。

【００５７】なお、図５に示すように、設置台５４上にはねじ止めにより保管棚５５を固定しているが、開閉自在なロック機構によりその保管棚５５を固定してもよい。このようにロック機構を持つことにより、設置台５５上には従来のプロセスウエハ用の保管棚２２（図１参照）をも固定できる。また、上述実施例では図３に示すように、ウエハ１１Ｊの中心位置、及び切欠き部（オリエンテーションフラット又はノッチ）の位置をそれぞれ、センサ台５０中の検出器、及び投光部５３を含む切欠きセンサにより検出していた。しかしながら、図８に示すように、調整台５１の上方の４箇所にスリット状の光ビームを下方に照射する投光部９０Ａ～９０Ｄを固定し、これら投光部９０Ａ～９０Ｄに対向し、且つウエハ１１Ｊの周縁部を挟むようにラインセンサを配置してもよい。この場合、ウエハ１１Ｊのエッジ部が各ラインセンサ上で所定位置にくるように、サーボ方式でスカラー型ロボットハンドのハンド部４５の位置をＲ方向、θ方向、あるいはＸ方向に駆動して位置決めすることにより、ウエハ１１Ｊの中心位置を概略にターンテーブル５２の中心位置に位置決めできる。

【００５８】また、それら４組の投光部及びラインセンサの組合せの内の例えば投光部９０Ａと、これに対向するラインセンサとを用いることにより、ウエハ１１Ｊの切欠き部（オリエンテーションフラット又はノッチ）の検出を行うこともできる。この場合、ウエハ１１Ｊ上の切欠き部がどの方向を向いていても、ラインセンサが４個設けてあるためウエハ１１Ｊを最大で９０°程度回転するだけでその切欠き部の位置を検出できる。なお、投光部及びラインセンサの組合せは２組以上であれば同様の位置決めが可能である。

【００５９】次に、本発明の第２実施例につき図９及び図１０を参照して説明する。本実施例は、図１の実施例においてウエハローダ系３８の横スライダ本体３９の長さを短くしたものであり、図９及び図１０において、図１及び図３に対応する部分には同一符号を付してその詳細説明を省略する。図９はこの第２実施例のチャンバ内の平面図であり、この図９において、第３の独立チャンバ３３の下部チャンバ内にウエハローダ系を設置し、このウエハローダ系のＸ方向のガイド部を、第１実施例の場合より短い横スライダ本体３９Ａより構成する。この横スライダ本体３９Ａに沿ってＸ方向に摺動自在に、ウエハを保持するためのスカラー型ロボットハンド４７を載置する。このスカラー型ロボットハンド４７によりチャンバの左側面の開口を通してウエハ１１Ｄ又は１１Ｅ等の受渡しを行うことができ、保管棚５５又は２２Ａとのウエハの受渡しをも行うことができる。

【００６０】また、横スライダ本体３９Ａの右端部に近接してセンサ台５０を設置し、このセンサ台５０に図４と同様に４組の投光部及び受光部を配置する。更に、そのセンサ台５０の右側に調整台５１を設置し、調整台５１上にターンテーブル５２を回転自在に取り付け、調整台５１の前側面に投光部５３を含むウエハの切欠き部（オリエンテーションフラット又はノッチ）の検出センサを取り付ける。本実施例では、その調整台５１の更に右側に縦スライダ本体４８が位置し、この縦スライダ本体４８に沿って摺動自在にスライダ４９Ａ及び４９Ｂが取り付けられている。また、調整台５１と縦スライダ本体４８との間に光ガイド７７を含む周辺露光部を設置する。その他の構成は第１実施例と同様である。

【００６１】この場合、本実施例では、スカラー型ロボットハンド４７で受け取ったウエハは、横スライダ本体３９Ａの右端部で位置決めを行ってターンテーブル５２上に設置される。図１０は、図９中のＧ部の拡大図であり、この図１０に示すように、この際にセンサ台５０によりウエハ１１Ｊの中心位置の検出が行われ、投光部５３を含む切欠きセンサによりウエハ１１Ｊの切欠き部の位置が検出される。また、光ガイド７７を含む周辺露光部により、必要に応じてウエハ１１Ｊの周辺露光が行われる。その後、ウエハ１１Ｊはスライダ４９Ａに渡され、露光装置本体側に搬送される。この第２実施例によれば、ウエハローダ系がコンパクトである。

【００６２】なお、本発明は上述実施例に限定されず、本発明の要旨を逸脱しない範囲で種々の構成を取り得ることは勿論である。

【００６３】

【発明の効果】本発明によれば、露光装置本体部と基板搬送手段とが別の環境維持室内に設置されているため、基板搬送手段（ウエハローダ系）で感光基板を搬送するときに生ずる振動が露光本体部に伝わりにくいと共に、基板搬送手段で発生した塵等が露光本体部に混入する確率が低減する利点がある。

【００６４】また、第３の環境維持室にマスク搬送手段を設置した場合には、更にマスク搬送手段（レチクルローダ系）で発生した塵等が露光本体部に混入する確率が低減する。更に、第１～第３の真空吸着源を互いに独立に設けた場合には、露光本体部、基板搬送手段、及びマスク搬送手段内での感光基板の吸着又は離脱の動作等が他の部分に影響を与えない利点がある。

【００６５】また、基板搬送手段が、２つの自由度を有する基板保持部を有する場合には、この基板保持部を介して外部装置（感光材のコータ、又は現像装置等）と感光基板の受渡しを行うことができるため、特に付加的な機構を設けることなく、感光基板の受渡しが容易にできる利点がある。また、その付加的な機構による感光基板の受渡しがなくなるため、感光基板の受渡し回数が減少し、発塵が少なくなり、且つ搬送動作の信頼性が向上する。

【００６６】また、感光基板の位置及び回転角を光学的に検出する基板状態検出手段を設けた場合には、感光基板を傷付けることなく且つ高速にその感光基板の位置及び回転角を検出できる利点がある。更に、感光基板の切欠き部又はノッチ等の位置も容易に検出できる。次に、基板搬送手段と感光基板との接触部を導電性セラミックスから形成した場合には、その基板搬送手段により搬送される感光基板の帯電が減少する利点がある。

【００６７】また、感光基板の保管部を、箱体と、この箱体に収納される感光基板の仕切り板とより形成し、それらの材料として導電性材料を用いた場合にも、感光基板の帯電を防止でき、且つ感光基板相互の塵等の付着を防止できる。更に、感光基板の間隔を十分に取れ、信頼性が向上する。また、その保管部内に検査又は清掃用の基板を収納する棚を確保した場合には、その保管棚から取り出した基板を用いて感光基板の搬送面の清掃を行うことにより、露光装置の稼働率低下、環境維持室内の温度変動、及び微細粒子の室外からの混入等を防止できる。

【図面の簡単な説明】

【図１】本発明による露光装置の第１実施例のチャンバ内の配置を示す平面断面図である。

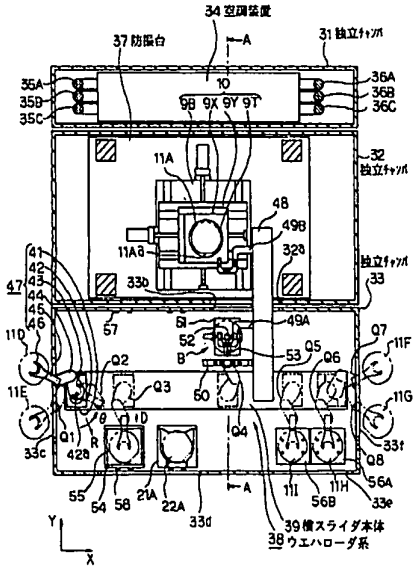
【図２】図１のＡＡ線に沿う断面図である。

【図３】図１のＢ部の拡大図である。

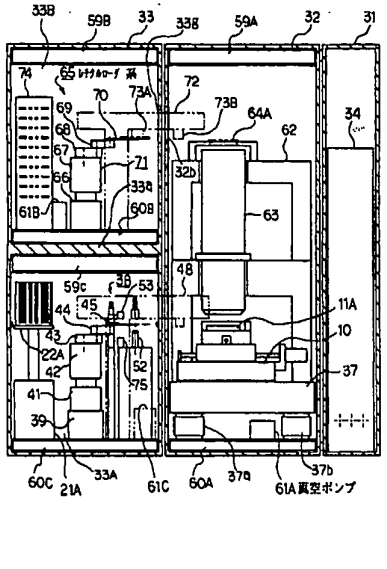
【図４】図３のＣＣ線に沿う矢視図である。

【図５】図１のＤ方向からの矢視図の拡大図である。
【図６】図５のＦＦ線に沿う断面図である。
【図７】図３のＥＥ線に沿う断面図である。
【図８】第１実施例の調整台５１付近のセンサの他の例を示す拡大平面図である。
【図９】本発明による露光装置の第２実施例のチャンバ内の配置を示す平面断面図である。
【図１０】図９のＧ部の拡大平面図である。
【図１１】従来のウエハローダ系を備えた露光装置を示す平面図である。
【図１２】図１１中のウエハローダ系１２の構成を示す斜視図である。
【符号の説明】
３１～３３　独立チャンバ
３３Ａ　下部チャンバ
３３Ｂ　上部チャンバ
１０　ウエハステージ
１１Ａ～１１Ｊ　ウエハ
３４　空調装置
３７　防振台
３８　ウエハローダ系
３９　横スライダ本体
４１　Ｘ軸移動部
４２　Ｚ軸移動部
４３　θ軸回転部
４４　Ｒ軸回転部
４５　ハンド部
４７　スカラー型ロボットハンド
４８　縦スライダ本体
４９Ａ，４９Ｂ　スライダ
５０　センサ台
５１　調整台
５２　タンテーブル
５４　設置台
５５　ウエハの保管棚
５３　投光部
５９Ａ～５９Ｃ　ＨＥＰＡフィルタ
６０Ａ～６０Ｃ　リターン
６５　レチクルローダ系
７５　ラインセンサ
７６Ａ～７６Ｄ　投光部
７８Ａ～７８Ｄ　受光部
７７　光ガイド
８４　ラインセンサ
８５　移動台

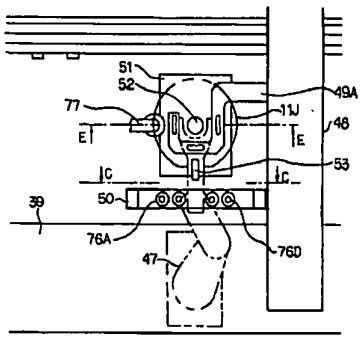
【図１】



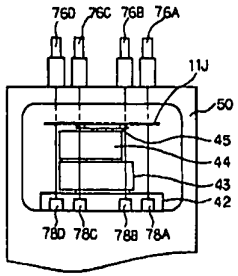
【図２】



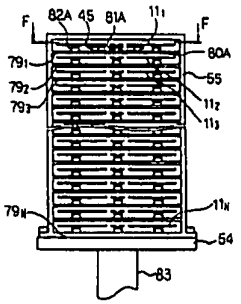
【図３】



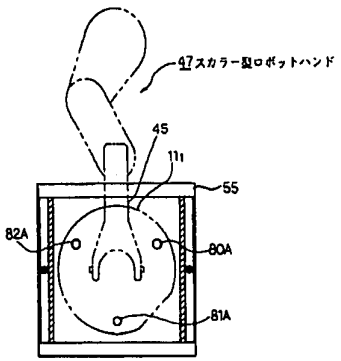
【図４】



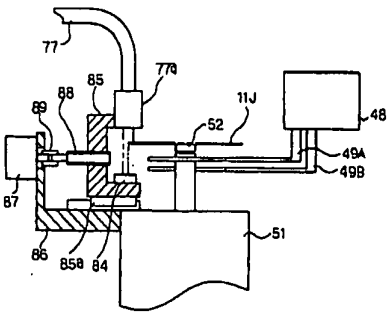
【図５】



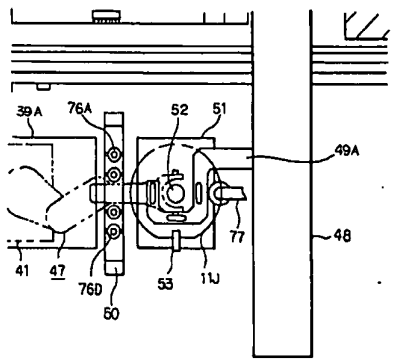
【図６】



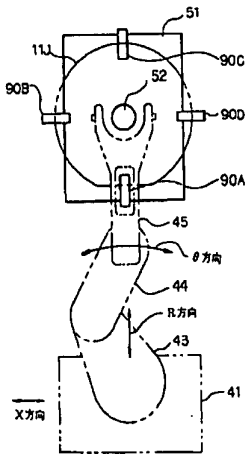
【図７】



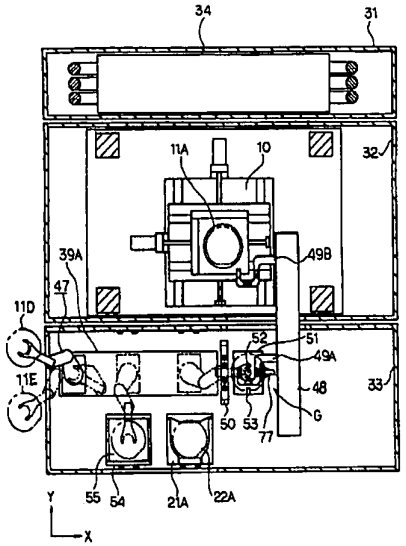
【図１０】



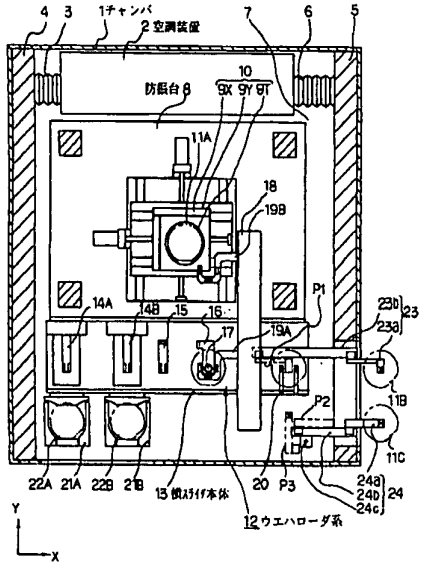
【図８】



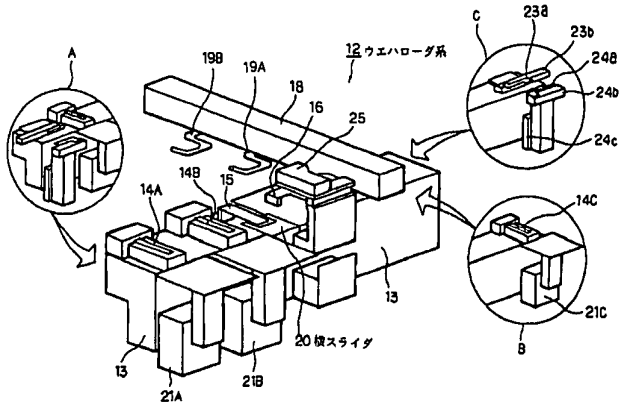
【図９】



【図１１】



【図１２】



フロントページの続き

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